



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 4 Winifred Moody Road
West End, Southampton, SO30 3LB

Contact: Tobias Whiting
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Report Issue Date: 20/09/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 27	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Property	4 Winifred Moody Road, West End, Southampton, SO30 3LB		
SAP Rating	87 B	DER	17.13
Environmental	87 B	% DER<TER	25.02
CO ₂ Emissions (t/year)	0.93	DFEE	65.23
General Requirements Compliance	Pass	% DFEE<TFEE	14.49
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	22.85	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	17.13	kgCO ₂ /m ²	Pass
	-5.72 (-25.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	76.29	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	65.23	kWh/m ² /yr	
	-11.1 (-14.5%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.26 (measured in this dwelling)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

This report has been produced by an accredited Elmhurst member whose work is subject to quality assurance audits. The data used to produce the report has been verified by the Elmhurst members' portal.

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 8000 Style GR8700iW 45 C NG
Combi boiler
Efficiency: 89.5% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

11.41 m², No overhang

Windows facing East

1.32 m², No overhang

Windows facing South

8.02 m², Overhang twice as wide as window, ratio 0.49

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.26 (measured in this dwelling) m³/(h.m²) @ 50 Pa

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Door U-value	1.10	W/m ² K
Thermal bridging ψ -value	0.027	W/m ² K
Photovoltaic array	1.15	kW

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THERMAL BRIDGING

Calculation Type: New Build (As Built)

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SAP Rating	87 B	DER	17.13
Environmental	87 B	TER	22.85
CO ₂ Emissions (t/year)	0.93	% DER<TER	25.02
General Requirements Compliance	Pass	DFEE	65.23
		TFEE	76.29
		% DFEE<TFEE	14.49
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.077	1.90	0.15	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	6.00	0.40	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.070	1.51	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.58	0.23	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.056	2.77	0.16	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	10.93	0.23	Knauf P5
External wall	E4 Jamb	Independently assessed	0.039	33.60	1.31	Knauf P6
External wall	E5 Ground floor (normal)	Independently assessed	0.105	37.76	3.96	LABC E5MCFF11
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	35.22	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	18.28	1.10	
External wall	E24 Eaves (insulation at ceiling level - inverted)	Independently assessed	0.151	3.27	0.49	Knauf P19
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	22.67	1.00	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	34.79	1.36	Knauf P23
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	-0.091	14.59	-1.33	Knauf P24

Total: 9.16 W/mK:
Y-Value: 0.027 W/m²K:

FULL SAP CALCULATION PRINTOUT

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CO ₂ Emissions (t/year)	0.93	DFEE	65.23	TFEE	76.29
General Requirements Compliance	Pass	% DFEE<TFEE	14.49		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001
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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Detached House, total floor area 82 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 22.85 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.13 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 76.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 65.2 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.26 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 8000 Style GR8700iW 45 C NG
Combi boiler
Efficiency: 89.5% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 11.41 m², No overhang
Windows facing East: 1.32 m², No overhang
Windows facing South: 8.02 m², Overhang twice as wide as window, ratio 0.49
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Thermal bridging y-value 0.027 W/m²K
Photovoltaic array 1.15 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.0268 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.2525 (8)
Pressure test					Yes
Measured/design AP50					4.2600
Infiltration rate					0.4655 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4306 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5490	0.5382	0.5275	0.4736	0.4629	0.4091	0.4091	0.3983	0.4306	0.4629	0.4844	0.5059 (22b)
Effective ac	0.6507	0.6448	0.6391	0.6122	0.6071	0.5837	0.5837	0.5793	0.5927	0.6071	0.6173	0.6280 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			172.9900			9.0000	1556.9100 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24500.2092 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 298.7830 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1601 (36)
Total fabric heat loss (33) + (36) = 90.4219 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	42.5221	42.1397	41.7649	40.0043	39.6750	38.1416	38.1416	37.8576	38.7322	39.6750	40.3413	41.0380 (38)
Average = Sum(39)m / 12 =	132.9440	132.5616	132.1868	130.4262	130.0968	128.5635	128.5635	128.2795	129.1541	130.0968	130.7632	131.4598 (39)
												130.4247 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.6213	1.6166	1.6120	1.5906	1.5865	1.5678	1.5678	1.5644	1.5750	1.5865	1.5947	1.6032 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4997 (42)
Average daily hot water use (litres/day)												93.5682 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.9250	99.1823	95.4396	91.6969	87.9541	84.2114	84.2114	87.9541	91.6969	95.4396	99.1823	102.9250 (44)
Energy content (annual)	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
										Total = Sum(45)m =		1472.1924 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.8952	20.0243	20.6633	18.0148	17.2856	14.9162	13.8220	15.8610	16.0504	18.7052	20.4182	22.1728 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8127	26.9017	29.6707	28.5852	29.4448	28.3874	29.2666	29.3821	28.4952	29.5772	28.7719	29.7771 (61)
Total heat required for water heating calculated for each month	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (64)
Heat gains from water heating, kWh/month	58.2043	51.1127	53.2213	47.0790	45.6776	40.1610	37.9554	42.5040	42.7022	48.8575	52.4532	56.5940 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1820.2650 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9314	17.7029	14.3970	10.8994	8.1474	6.8784	7.4324	9.6609	12.9668	16.4643	19.2163	20.4854 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.5697	225.8896	220.0434	207.5975	191.8868	177.1210	167.2565	164.9365	170.7828	183.2286	198.9393	213.7052 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886 (71)
Water heating gains (Table 5)	78.2316	76.0605	71.5340	65.3876	61.3946	55.7791	51.0154	57.1290	59.3086	65.6686	72.8517	76.0672 (72)
Total internal gains	385.2283	383.1487	369.4701	347.3802	324.9246	303.2743	289.2000	295.2222	306.5538	328.8573	354.5031	373.7535 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			11.4100		10.6334		0.6300		0.7000		0.7700		37.0791 (74)
East			1.3200		19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South			8.0200		46.7521		0.6300		0.7000		0.7700		114.5901 (78)
Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429	(83)
Total gains	544.8206	657.1770	754.4607	848.2003	912.6351	899.8442	858.8025	797.1081	730.7339	634.0167	545.9524	510.1963	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.1916	51.3393	51.4848	52.1798	52.3119	52.9358	52.9358	53.0530	52.6938	52.3119	52.0453	51.7695
alpha	4.4128	4.4226	4.4323	4.4787	4.4875	4.5291	4.5291	4.5369	4.5129	4.4875	4.4697	4.4513
util living area	0.9985	0.9962	0.9902	0.9703	0.9119	0.7807	0.6210	0.6797	0.8895	0.9820	0.9968	0.9989 (86)
MIT	19.4519	19.6326	19.9183	20.2994	20.6494	20.8880	20.9699	20.9550	20.7757	20.3220	19.8193	19.4268 (87)
Th 2	19.5978	19.6012	19.6045	19.6203	19.6232	19.6370	19.6370	19.6396	19.6317	19.6232	19.6172	19.6110 (88)
util rest of house	0.9978	0.9946	0.9857	0.9552	0.8638	0.6654	0.4476	0.5080	0.8093	0.9700	0.9951	0.9984 (89)
MIT 2	18.2215	18.4041	18.6902	19.0747	19.3981	19.5915	19.6313	19.6296	19.5172	19.1044	18.6033	18.2066 (90)
Living area fraction									fLA = Living area / (4) =			0.3279 (91)
MIT	18.6250	18.8070	19.0930	19.4763	19.8085	20.0167	20.0703	20.0643	19.9299	19.5037	19.0021	18.6067 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6250	18.8070	19.0930	19.4763	19.8085	20.0167	20.0703	20.0643	19.9299	19.5037	19.0021	18.6067 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	543.2646	652.7442	741.9268	808.4321	795.4743	631.2911	434.8060	451.4897	606.9854	614.0851	542.6604	509.1094 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1904.4253	1843.5324	1664.6214	1379.4309	1054.8861	696.3872	446.1520	470.0502	752.9585	1158.3386	1556.3526	1893.9079 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1012.7036	800.2096	686.4848	411.1191	193.0024	0.0000	0.0000	0.0000	0.0000	404.9246	729.8584	1030.2901 (98)
Space heating												5268.5925 (98)
Space heating per m2												(98) / (4) = 64.2511 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5828.0891 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1012.7036	800.2096	686.4848	411.1191	193.0024	0.0000	0.0000	0.0000	0.0000	404.9246	729.8584	1030.2901	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	1120.2473	885.1877	759.3858	454.7778	213.4982	0.0000	0.0000	0.0000	0.0000	447.9254	807.3655	1139.7014	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959	(64)
Efficiency of water heater (217)m	90.0571	90.0251	89.9600	89.8050	89.4441	88.2000	88.2000	88.2000	88.2000	89.7822	89.9864	88.2000	(216)
Fuel for water heating, kWh/month	202.5911	178.1694	186.1115	165.5627	161.7570	144.9301	137.6568	153.1994	153.6256	171.8364	183.2422	197.1761	(219)
Water heating fuel used												2035.8583	(219)
Annual totals kWh/year													
Space heating fuel - main system												5828.0891	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9947	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1080 * 1.00) =										-993.1627		-993.1627	(233)
Total delivered energy for all uses												7297.7794	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5828.0891	0.2160	1258.8672 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2035.8583	0.2160	439.7454 (264)
Space and water heating			1698.6126 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	351.9947	0.5190	182.6853 (268)
Energy saving/generation technologies			
PV Unit	-993.1627	0.5190	-515.4514 (269)
Total CO2, kg/year			1404.7715 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.1300 (273)

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

DER			17.1300 ZC1
Total Floor Area		TFA	82.0000
Assumed number of occupants		N	2.4997
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.1564 ZC2
CO2 emissions from cooking, equation (L16)			2.1828 ZC3
Total CO2 emissions			35.4693 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			35.4693 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 198.0268 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1515 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4015 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3714 (21)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4735	0.4642	0.4549	0.4085	0.3992	0.3528	0.3528	0.3435	0.3714	0.3992	0.4178	0.4364	(22b)				
Effective ac	0.6121	0.6078	0.6035	0.5834	0.5797	0.5622	0.5622	0.5590	0.5690	0.5797	0.5873	0.5952	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			18.3800	1.3258	24.3674		(27)					
Ground Floor			74.6900	0.1300	9.7097		(28a)					
Brick and Block	184.2800	20.5000	163.7800	0.1800	29.4804		(29a)					
Pitched Roof	74.6900		74.6900	0.1300	9.7097		(30)					
Total net area of external elements Aum(A, m2)			333.6600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	75.3872		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1159 (36)					
Total fabric heat loss						(33) + (36) =	89.5031 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.0005	Feb 39.7160	Mar 39.4372	Apr 38.1274	May 37.8824	Jun 36.7416	Jul 36.7416	Aug 36.5304	Sep 37.1810	Oct 37.8824	Nov 38.3781	Dec 38.8964 (38)
Heat transfer coeff	129.5036	129.2191	128.9403	127.6306	127.3855	126.2448	126.2448	126.0335	126.6842	127.3855	127.8812	128.3995 (39)
Average = Sum(39)m / 12 =												127.6294 (39)
HLP	Jan 1.5793	Feb 1.5758	Mar 1.5724	Apr 1.5565	May 1.5535	Jun 1.5396	Jul 1.5396	Aug 1.5370	Sep 1.5449	Oct 1.5535	Nov 1.5595	Dec 1.5658 (40)
HLP (average)												1.5565 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4997 (42)
Average daily hot water use (litres/day)												93.5682 (43)
Daily hot water use	Jan 102.9250	Feb 99.1823	Mar 95.4396	Apr 91.6969	May 87.9541	Jun 84.2114	Jul 84.2114	Aug 87.9541	Sep 91.6969	Oct 95.4396	Nov 99.1823	Dec 102.9250 (44)
Energy conte	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
Energy content (annual)										Total = Sum(45)m =		1472.1924 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8952	20.0243	20.6633	18.0148	17.2856	14.9162	13.8220	15.8610	16.0504	18.7052	20.4182	22.1728 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	45.6510	48.6350	45.2204	44.8205	41.5289	42.9132	44.8205	45.2204	48.6350	48.9118	50.9589 (61)
Solar input	203.5938	179.1465	186.3903	165.3188	160.0578	140.9699	135.0599	150.5602	152.2230	173.3362	185.0329	198.7776 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	203.5938	179.1465	186.3903	165.3188	160.0578	140.9699	135.0599	150.5602	152.2230	173.3362	185.0329	198.7776 (64)
	63.4908	55.8000	57.9624	51.2378	49.5215	43.4464	41.3671	46.3636	46.8835	53.6219	57.4882	61.8894 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9296	17.7013	14.3956	10.8984	8.1467	6.8778	7.4317	9.6600	12.9656	16.4628	19.2146	20.4835	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.5697	225.8896	220.0434	207.5975	191.8868	177.1210	167.2565	164.9365	170.7828	183.2286	198.9393	213.7052	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	(71)
Water heating gains (Table 5)	85.3371	83.0357	77.9064	71.1636	66.5612	60.3422	55.6009	62.3166	65.1159	72.0724	79.8448	83.1847	(72)
Total internal gains	392.3321	390.1223	375.8412	353.1553	330.0904	307.8367	293.7848	300.4089	312.3600	335.2596	361.4944	380.8691	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					10.1000	10.6334	0.6300	0.7000			0.7700			32.8220 (74)
East					1.1700	19.6403	0.6300	0.7000			0.7700			7.0227 (76)
South					7.1100	46.7521	0.6300	0.7000			0.7700			101.5880 (78)

Solar gains	141.4327	242.8373	341.1408	443.7273	520.6669	528.4962	504.6140	444.6544	375.8501	270.4175	169.6630	120.9185	(83)	
Total gains	533.7647	632.9596	716.9820	796.8826	850.7574	836.3328	798.3988	745.0632	688.2101	605.6771	531.1574	501.7876	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.9713	44.0681	44.1634	44.6166	44.7025	45.1064	45.1064	45.1820	44.9499	44.7025	44.5292	44.3494	
alpha	3.9314	3.9379	3.9442	3.9744	3.9802	4.0071	4.0071	4.0121	3.9967	3.9802	3.9686	3.9566	
util living area	0.9969	0.9936	0.9858	0.9638	0.9066	0.7862	0.6367	0.6899	0.8827	0.9754	0.9942	0.9976	(86)
MIT	19.2679	19.4572	19.7633	20.1721	20.5589	20.8392	20.9496	20.9297	20.7151	20.2169	19.6683	19.2363	(87)
Th 2	19.6285	19.6311	19.6336	19.6454	19.6476	19.6580	19.6580	19.6599	19.6540	19.6476	19.6431	19.6385	(88)
util rest of house	0.9958	0.9912	0.9803	0.9481	0.8621	0.6809	0.4696	0.5275	0.8086	0.9618	0.9916	0.9967	(89)
MIT 2	17.3670	17.6445	18.0906	18.6834	19.2117	19.5497	19.6405	19.6319	19.4238	18.7569	17.9614	17.3273	(90)
Living area fraction	17.9904	18.2389	18.6391	19.1716	19.6535	19.9725	20.0698	20.0575	19.8472	19.2357	18.5211	17.9533	(91)
MIT	17.9904	18.2389	18.6391	19.1716	19.6535	19.9725	20.0698	20.0575	19.8472	19.2357	18.5211	17.9533	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.9904	18.2389	18.6391	19.1716	19.6535	19.9725	20.0698	20.0575	19.8472	19.2357	18.5211	17.9533	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9937	0.9877	0.9745	0.9408	0.8624	0.7091	0.5251	0.5809	0.8217	0.9560	0.9884	0.9951	(94)
Ext temp.	530.4280	625.1529	698.7289	749.7093	733.6709	593.0289	419.2741	432.8281	565.5263	578.9991	525.0143	499.3097	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1772.9535	1723.6439	1565.2242	1310.9722	1013.1630	678.2553	438.0418	460.9696	728.0831	1100.0599	1460.5493	1765.9169	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	924.4390	738.1859	644.6725	404.1093	207.9421	0.0000	0.0000	0.0000	0.0000	387.6693	673.5852	942.3558	(98)
Space heating per m2												4922.9591	(98)
												60.0361	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5270.8341 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	924.4390	738.1859	644.6725	404.1093	207.9421	0.0000	0.0000	0.0000	0.0000	387.6693	673.5852	942.3558 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	989.7634	790.3490	690.2275	432.6652	222.6361	0.0000	0.0000	0.0000	0.0000	415.0635	721.1833	1008.9463 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	203.5938	179.1465	186.3903	165.3188	160.0578	140.9699	135.0599	150.5602	152.2230	173.3362	185.0329	198.7776 (64)
Efficiency of water heater (217)m	88.3934	88.2327	87.9198	87.2152	85.7111	80.3000	80.3000	80.3000	80.3000	87.0183	88.0143	80.3000 (216)
Fuel for water heating, kWh/month	230.3270	203.0386	212.0003	189.5527	186.7410	175.5541	168.1942	187.4971	189.5678	199.1951	210.2304	224.7044 (219)
Water heating fuel used												2376.6028 (219)
Annual totals kWh/year												
Space heating fuel - main system												5270.8341 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												351.9624 (232)
Total delivered energy for all uses												8074.3993 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5270.8341	0.2160	1138.5002 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2376.6028	0.2160	513.3462 (264)
Space and water heating			1651.8464 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	351.9624	0.5190	182.6685 (268)
Total CO2, kg/m2/year			1873.4398 (272)
Emissions per m2 for space and water heating			20.1445 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2277 (272b)
Emissions per m2 for pumps and fans			0.4747 (272c)
Target Carbon Dioxide Emission Rate (TER) = (20.1445 * 1.00) + 2.2277 + 0.4747, rounded to 2 d.p.			22.8500 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.0268 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1515 (8)
Pressure test					Yes
Measured/design AP50					4.2600
Infiltration rate					0.3645 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3372 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4299	0.4214	0.4130	0.3709	0.3624	0.3203	0.3203	0.3119	0.3372	0.3624	0.3793	0.3962 (22b)
Effective ac	0.5924	0.5888	0.5853	0.5688	0.5657	0.5513	0.5513	0.5486	0.5568	0.5657	0.5719	0.5785 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			172.9900			9.0000	1556.9100 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			9.0000	658.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23841.9492 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							290.7555 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1601 (36)
Total fabric heat loss						(33) + (36) =	90.4219 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.7124	38.4780	38.2482	37.1687	36.9667	36.0266	36.0266	35.8524	36.3887	36.9667	37.3753	37.8024 (38)
Heat transfer coeff	129.1343	128.8999	128.6700	127.5906	127.3886	126.4484	126.4484	126.2743	126.8106	127.3886	127.7972	128.2243 (39)
Average = Sum(39)m / 12 =												127.5896 (39)
HLP	1.5748	1.5719	1.5691	1.5560	1.5535	1.5421	1.5421	1.5399	1.5465	1.5535	1.5585	1.5637 (40)
HLP (average)												1.5560 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4997 (42)
Average daily hot water use (litres/day)												93.5682 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.9250	99.1823	95.4396	91.6969	87.9541	84.2114	84.2114	87.9541	91.6969	95.4396	99.1823	102.9250 (44)
Energy conte	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
Energy content (annual)										Total = Sum(45)m =		1472.1924 (45)

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Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	32.4349	28.3678	29.2730	25.5209	24.4879	21.1312	19.5812	22.4697	22.7380	26.4990	28.9257	31.4115 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9314	17.7029	14.3970	10.8994	8.1474	6.8784	7.4324	9.6609	12.9668	16.4643	19.2163	20.4854	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.5697	225.8896	220.0434	207.5975	191.8868	177.1210	167.2565	164.9365	170.7828	183.2286	198.9393	213.7052	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	(71)
Water heating gains (Table 5)	43.5953	42.2140	39.3454	35.4457	32.9139	29.3489	26.3188	30.2012	31.5806	35.6169	40.1746	42.2197	(72)
Total internal gains	347.5921	346.3022	334.2815	314.4384	293.4439	273.8440	261.5034	265.2943	275.8259	295.8056	318.8260	336.9060	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				11.4100	10.6334		0.6300		0.7000		0.7700		37.0791 (74)
East				1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South				8.0200	46.7521		0.6300		0.7000		0.7700		114.5901 (78)
Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429	(83)
Total gains	507.1843	620.3305	719.2721	815.2584	881.1544	870.4139	831.1059	767.1803	700.0059	600.9650	510.2753	473.3489	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.2859	51.3791	51.4709	51.9064	51.9887	52.3752	52.3752	52.4474	52.2256	51.9887	51.8225	51.6498	
alpha	4.4191	4.4253	4.4314	4.4604	4.4659	4.4917	4.4917	4.4965	4.4817	4.4659	4.4548	4.4433	
util living area	0.9987	0.9966	0.9910	0.9718	0.9148	0.7869	0.6284	0.6899	0.8957	0.9838	0.9972	0.9991	(86)
MIT	19.4333	19.6160	19.9044	20.2843	20.6393	20.8814	20.9675	20.9508	20.7635	20.3012	19.7935	19.4010	(87)
Th 2	19.6319	19.6340	19.6360	19.6458	19.6476	19.6561	19.6561	19.6577	19.6528	19.6476	19.6439	19.6401	(88)
util rest of house	0.9982	0.9952	0.9868	0.9576	0.8689	0.6748	0.4569	0.5206	0.8200	0.9731	0.9958	0.9987	(89)
MIT 2	18.2327	18.4164	18.7044	19.0837	19.4125	19.6065	19.6497	19.6463	19.5287	19.1068	18.6017	18.2067	(90)
Living area fraction	18.6264	18.8097	19.0979	19.4774	19.8148	20.0246	20.0818	20.0741	19.9336	19.4985	18.9926	18.5983	(91)
Temperature adjustment	18.6264	18.8097	19.0979	19.4774	19.8148	20.0246	20.0818	20.0741	19.9336	19.4985	18.9926	18.5983	(92)
adjusted MIT	18.6264	18.8097	19.0979	19.4774	19.8148	20.0246	20.0818	20.0741	19.9336	19.4985	18.9926	18.5983	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9940	0.9846	0.9553	0.8758	0.7095	0.5149	0.5782	0.8394	0.9715	0.9948	0.9982	(94)
Ext temp.	505.9742	616.6171	708.2131	778.8564	771.6888	617.5767	427.9654	443.5491	587.5931	583.8348	507.6468	472.5164	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1850.0323	1792.9636	1620.9682	1349.5754	1033.7348	685.9262	440.2710	463.9390	739.7679	1133.5629	1519.8350	1846.2186	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(98)
Space heating per m2	999.9793	790.5048	679.0899	410.9177	194.9622	0.0000	0.0000	0.0000	0.0000	408.9977	728.7755	1022.0344	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1188.6153	935.7184	959.6849	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7891	0.8659	0.8304	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	937.9742	810.1988	796.9304	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1110.6864	1062.7978	989.6396	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	124.3528	187.9337	143.3756	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												455.6621 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	31.0882	46.9834	35.8439	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												113.9155 (107)
Space cooling per m2												1.3892 (108)
Energy for space heating												63.8447 (99)
Energy for space cooling												1.3892 (108)
Total												65.2339 (109)
Dwelling Fabric Energy Efficiency (DFEE)												65.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(3a) + (3b) + (3c) + (3d) + (3e)...(3n) = 198.0268 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1515 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4015 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3714 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4735	0.4642	0.4549	0.4085	0.3992	0.3528	0.3528	0.3435	0.3714	0.3992	0.4178	0.4364	(22b)				
Effective ac	0.6121	0.6078	0.6035	0.5834	0.5797	0.5622	0.5622	0.5590	0.5690	0.5797	0.5873	0.5952	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			18.3800	1.3258	24.3674		(27)					
Ground Floor			74.6900	0.1300	9.7097		(28a)					
Brick and Block	184.2800	20.5000	163.7800	0.1800	29.4804		(29a)					
Pitched Roof	74.6900		74.6900	0.1300	9.7097		(30)					
Total net area of external elements Aum(A, m2)			333.6600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.3872		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1159 (36)					
Total fabric heat loss						(33) + (36) =	89.5031 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.0005	39.7160	39.4372	38.1274	37.8824	36.7416	36.7416	36.5304	37.1810	37.8824	38.3781	38.8964 (38)
Heat transfer coeff	129.5036	129.2191	128.9403	127.6306	127.3855	126.2448	126.2448	126.0335	126.6842	127.3855	127.8812	128.3995 (39)
Average = Sum(39)m / 12 =												127.6294 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.5793	1.5758	1.5724	1.5565	1.5535	1.5396	1.5396	1.5370	1.5449	1.5535	1.5595	1.5658 (40)
HLP (average)												1.5565 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4997 (42)
Average daily hot water use (litres/day)												93.5682 (43)
Daily hot water use	Jan 102.9250	Feb 99.1823	Mar 95.4396	Apr 91.6969	May 87.9541	Jun 84.2114	Jul 84.2114	Aug 87.9541	Sep 91.6969	Oct 95.4396	Nov 99.1823	Dec 102.9250 (44)
Energy conte	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
Energy content (annual)										Total = Sum(45)m =		1472.1924 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	32.4349	28.3678	29.2730	25.5209	24.4879	21.1312	19.5812	22.4697	22.7380	26.4990	28.9257	31.4115 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857	124.9857 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9296	17.7013	14.3956	10.8984	8.1467	6.8778	7.4317	9.6600	12.9656	16.4628	19.2146	20.4835 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	223.5697	225.8896	220.0434	207.5975	191.8868	177.1210	167.2565	164.9365	170.7828	183.2286	198.9393	213.7052 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986	35.4986 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886 (71)
Water heating gains (Table 5)	43.5953	42.2140	39.3454	35.4457	32.9139	29.3489	26.3188	30.2012	31.5806	35.6169	40.1746	42.2197 (72)
Total internal gains	347.5902	346.3005	334.2802	314.4374	293.4431	273.8434	261.5027	265.2935	275.8247	295.8041	318.8242	336.9041 (73)

6. Solar gains												

[Jan]												
	Area											
	m2											
	Solar flux											
	Table 6a											
	W/m2											
	Specific data											
	or Table 6b											
	Specific data											
	or Table 6c											
	Access											
	factor											
	Table 6d											
	Gains											
	W											
North	10.1000											32.8220 (74)
East	1.1700											7.0227 (76)
South	7.1100											101.5880 (78)

Solar gains	141.4327	242.8373	341.1408	443.7273	520.6669	528.4962	504.6140	444.6544	375.8501	270.4175	169.6630	120.9185 (83)
Total gains	489.0229	589.1379	675.4210	758.1647	814.1101	802.3396	766.1167	709.9478	651.6748	566.2216	488.4873	457.8226 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.9713	44.0681	44.1634	44.6166	44.7025	45.1064	45.1064	45.1820	44.9499	44.7025	44.5292	44.3494
alpha	3.9314	3.9379	3.9442	3.9744	3.9802	4.0071	4.0071	4.0121	3.9967	3.9802	3.9686	3.9566
util living area	0.9978	0.9950	0.9884	0.9690	0.9169	0.8031	0.6564	0.7124	0.8977	0.9803	0.9957	0.9983 (86)
MIT	19.2210	19.4118	19.7216	20.1366	20.5324	20.8250	20.9437	20.9209	20.6911	20.1787	19.6239	19.1900 (87)
Th 2	19.6285	19.6311	19.6336	19.6454	19.6476	19.6580	19.6580	19.6599	19.6540	19.6476	19.6431	19.6385 (88)
util rest of house	0.9969	0.9932	0.9838	0.9553	0.8758	0.7003	0.4873	0.5497	0.8293	0.9690	0.9938	0.9977 (89)
MIT 2	18.0377	18.2298	18.5393	18.9553	19.3282	19.5760	19.6444	19.6378	19.4796	19.0034	18.4509	18.0143 (90)
Living area fraction									fLA = Living area / (4) =			0.3279 (91)
MIT	18.4257	18.6174	18.9270	19.3426	19.7231	19.9856	20.0705	20.0586	19.8769	19.3888	18.8356	18.3998 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4257	18.6174	18.9270	19.3426	19.7231	19.9856	20.0705	20.0586	19.8769	19.3888	18.8356	18.3998 (93)

8. Space heating requirement												

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9959	0.9912	0.9806	0.9513	0.8786	0.7292	0.5441	0.6040	0.8434	0.9661	0.9921	0.9968 (94)
Ext temp.	487.0169	583.9756	662.2939	721.2059	715.2950	585.0793	416.8477	428.7759	549.6185	547.0188	484.6417	456.3738 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1829.3350	1772.5498	1602.3453	1332.8003	1022.0260	679.9010	438.1274	461.1017	731.8433	1119.5676	1500.7591	1823.2493 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	998.6847	798.7218	699.3983	440.3480	228.2078	0.0000	0.0000	0.0000	0.0000	425.9764	731.6045	1016.9554 (98)
Space heating												5339.8968 (98)
Space heating per m2										(98) / (4) =		65.1207 (99)

8c. Space cooling requirement												

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1186.7008	934.2113	957.8548	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7405	0.8216	0.7853	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	878.7568	767.5370	752.1689	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1031.1181	986.8354	922.7433	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	109.7002	163.1580	126.9074	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												399.7656 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	27.4250	40.7895	31.7268	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												99.9414 (107)
Space cooling per m2												1.2188 (108)
Energy for space heating												65.1207 (99)
Energy for space cooling												1.2188 (108)
Total												66.3395 (109)
Target Fabric Energy Efficiency (TFEE)												76.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.0268 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.2525 (8)
Pressure test					Yes
Measured/design AP50					4.2600
Infiltration rate					0.4655 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4306 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
Effective ac	0.5059	0.4736	0.4736	0.4306	0.4413	0.4198	0.4198	0.4091	0.4091	0.4413	0.4306	0.4413 (22b)
	0.6280	0.6122	0.6122	0.5927	0.5974	0.5881	0.5881	0.5837	0.5837	0.5974	0.5927	0.5974 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			172.9900			9.0000	1556.9100 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24500.2092 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 298.7830 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1601 (36)
Total fabric heat loss (33) + (36) = 90.4219 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.0380	40.0043	40.0043	38.7322	39.0389	38.4331	38.4331	38.1416	38.1416	39.0389	38.7322	39.0389 (38)
Heat transfer coeff	131.4598	130.4262	130.4262	129.1541	129.4608	128.8550	128.8550	128.5635	128.5635	129.4608	129.1541	129.4608 (39)
Average = Sum(39)m / 12 =												129.4866 (39)
HLP	1.6032	1.5906	1.5906	1.5750	1.5788	1.5714	1.5714	1.5678	1.5678	1.5788	1.5750	1.5788 (40)
HLP (average)												1.5791 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4997 (42)
Average daily hot water use (litres/day)												93.5682 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.9250	99.1823	95.4396	91.6969	87.9541	84.2114	84.2114	87.9541	91.6969	95.4396	99.1823	102.9250 (44)
Energy conte	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
Energy content (annual)										Total = Sum(45)m =		1472.1924 (45)

Distribution loss	(46)m = 0.15 x (45)m											
	22.8952	20.0243	20.6633	18.0148	17.2856	14.9162	13.8220	15.8610	16.0504	18.7052	20.4182	22.1728 (46)
Water storage loss												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8127	26.9017	29.6707	28.5852	29.4448	28.3874	29.2666	29.3821	28.4952	29.5772	28.7719	29.7771 (61)
Total heat required for water heating calculated for each month												
	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				
												0.0000 (63)
Output from w/h												
	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (64)
								Total per year (kWh/year) = Sum(64)m =				
												1820.2650 (64)
												1820 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
	58.2043	51.1127	53.2213	47.0790	45.6776	40.1610	37.9554	42.5040	42.7022	48.8575	52.4532	56.5940 (65)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.0268 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.2525 (8)
Pressure test					Yes
Measured/design AP50					4.2600
Infiltration rate					0.4655 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4306 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5490	0.5382	0.5275	0.4736	0.4629	0.4091	0.4091	0.3983	0.4306	0.4629	0.4844	0.5059 (22b)
Effective ac	0.6507	0.6448	0.6391	0.6122	0.6071	0.5837	0.5837	0.5793	0.5927	0.6071	0.6173	0.6280 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			172.9900			9.0000	1556.9100 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24500.2092 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 298.7830 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1601 (36)
Total fabric heat loss (33) + (36) = 90.4219 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.5221	42.1397	41.7649	40.0043	39.6750	38.1416	38.1416	37.8576	38.7322	39.6750	40.3413	41.0380 (38)
Heat transfer coeff	132.9440	132.5616	132.1868	130.4262	130.0968	128.5635	128.5635	128.2795	129.1541	130.0968	130.7632	131.4598 (39)
Average = Sum(39)m / 12 =												130.4247 (39)
HLP	1.6213	1.6166	1.6120	1.5906	1.5865	1.5678	1.5678	1.5644	1.5750	1.5865	1.5947	1.6032 (40)
HLP (average)												1.5905 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4997 (42)
Average daily hot water use (litres/day) 93.5682 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.9250	99.1823	95.4396	91.6969	87.9541	84.2114	84.2114	87.9541	91.6969	95.4396	99.1823	102.9250 (44)
Energy conte	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
Energy content (annual)										Total = Sum(45)m =		1472.1924 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.8952	20.0243	20.6633	18.0148	17.2856	14.9162	13.8220	15.8610	16.0504	18.7052	20.4182	22.1728 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8127	26.9017	29.6707	28.5852	29.4448	28.3874	29.2666	29.3821	28.4952	29.5772	28.7719	29.7771 (61)
Total heat required for water heating calculated for each month	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (64)
Heat gains from water heating, kWh/month	58.2043	51.1127	53.2213	47.0790	45.6776	40.1610	37.9554	42.5040	42.7022	48.8575	52.4532	56.5940 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1820.2650 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.8285	44.2572	35.9924	27.2486	20.3686	17.1960	18.5809	24.1522	32.4170	41.1609	48.0408	51.2134 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.6861	337.1487	328.4230	309.8470	286.3982	264.3597	249.6366	246.1740	254.8996	273.4756	296.9244	318.9629 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886 (71)
Water heating gains (Table 5)	78.2316	76.0605	71.5340	65.3876	61.3946	55.7791	51.0154	57.1290	59.3086	65.6686	72.8517	76.0672 (72)
Total internal gains	567.2384	562.9587	541.4417	507.9754	473.6538	442.8272	424.7252	432.9475	452.1175	485.7974	523.3092	551.7358 (73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			11.4100		10.6334		0.6300		0.7000		0.7700		37.0791 (74)
East			1.3200		19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South			8.0200		46.7521		0.6300		0.7000		0.7700		114.5901 (78)
Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429	(83)
Total gains	726.8306	836.9870	926.4323	1008.7955	1061.3643	1039.3971	994.3277	934.8334	876.2975	790.9568	714.7585	688.1787	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.1916	51.3393	51.4848	52.1798	52.3119	52.9358	52.9358	53.0530	52.6938	52.3119	52.0453	51.7695
alpha	4.4128	4.4226	4.4323	4.4787	4.4875	4.5291	4.5291	4.5369	4.5129	4.4875	4.4697	4.4513
util living area	0.9951	0.9903	0.9790	0.9468	0.8670	0.7127	0.5490	0.5999	0.8254	0.9606	0.9906	0.9962 (86)
MIT	19.6175	19.7935	20.0662	20.4220	20.7310	20.9236	20.9815	20.9727	20.8439	20.4493	19.9712	19.5897 (87)
Th 2	19.5978	19.6012	19.6045	19.6203	19.6232	19.6370	19.6370	19.6396	19.6317	19.6232	19.6172	19.6110 (88)
util rest of house	0.9931	0.9863	0.9700	0.9225	0.8056	0.5933	0.3892	0.4382	0.7266	0.9374	0.9860	0.9946 (89)
MIT 2	18.3861	18.5630	18.8335	19.1864	19.4601	19.6082	19.6338	19.6341	19.5594	19.2217	18.7530	18.3688 (90)
Living area fraction	18.7899	18.9665	19.2378	19.5916	19.8769	20.0396	20.0757	20.0730	19.9806	19.6243	19.1525	18.7691 (92)
MIT	18.7899	18.9665	19.2378	19.5916	19.8769	20.0396	20.0757	20.0730	19.9806	19.6243	19.1525	18.7691 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7899	18.9665	19.2378	19.5916	19.8769	20.0396	20.0757	20.0730	19.9806	19.6243	19.1525	18.7691 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9915	0.9838	0.9669	0.9219	0.8187	0.6316	0.4427	0.4926	0.7557	0.9374	0.9838	0.9932 (94)
Ext temp.	720.6647	823.4635	895.7400	929.9720	868.9346	656.5257	440.2010	460.4964	662.1982	741.4300	703.2077	683.5307 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1926.3495	1864.6822	1683.7634	1394.4657	1063.7832	699.3328	446.8539	471.1768	759.5085	1174.0318	1576.0244	1915.2549 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	897.0295	699.6990	586.2894	334.4354	144.9673	0.0000	0.0000	0.0000	0.0000	321.8557	628.4280	916.4028 (98)
Space heating per m2												4529.1072 (98)
												(98) / (4) = 55.2330 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5010.0743 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	897.0295	699.6990	586.2894	334.4354	144.9673	0.0000	0.0000	0.0000	0.0000	321.8557	628.4280	916.4028	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	992.2892	774.0033	648.5502	369.9507	160.3621	0.0000	0.0000	0.0000	0.0000	356.0351	695.1637	1013.7199	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959	(64)
Efficiency of water heater (217)m	90.0205	89.9814	89.9019	89.7113	89.2875	88.2000	88.2000	88.2000	88.2000	89.6752	89.9337	88.2000	(216)
Fuel for water heating, kWh/month	202.6734	178.2558	186.2319	165.7357	162.0406	144.9301	137.6568	153.1994	153.6256	172.0413	183.3494	197.2511	(219)
Water heating fuel used												2036.9911	(219)
Annual totals kWh/year													
Space heating fuel - main system												5010.0743	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9947	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1080 * 1.00) =										-993.1627		-993.1627	(233)
Total delivered energy for all uses												6480.8975	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5010.0743	3.4800	174.3506 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2036.9911	3.4800	70.8873 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	351.9947	13.1900	46.4281 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-993.1627	13.1900	-130.9982 (252)
Total energy cost			290.5603 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.9609 (257)
SAP value		86.5953
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5010.0743	0.2160	1082.1761 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2036.9911	0.2160	439.9901 (264)
Space and water heating			1522.1661 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	351.9947	0.5190	182.6853 (268)
Energy saving/generation technologies			
PV Unit	-993.1627	0.5190	-515.4514 (269)
Total kg/year			1228.3250 (272)
CO2 emissions per m2			14.9800 (273)
EI value			87.0397
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8928 = 3.898$, stars = 4
Water heating environmental impact	$0.216 / 0.8928 = 0.2419$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.0268 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.2525 (8)
Pressure test					Yes
Measured/design AP50					4.2600
Infiltration rate					0.4655 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4306 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor	1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate												
Effective ac	0.5059	0.4736	0.4736	0.4306	0.4413	0.4198	0.4198	0.4091	0.4091	0.4413	0.4306	0.4413 (22b)
	0.6280	0.6122	0.6122	0.5927	0.5974	0.5881	0.5881	0.5837	0.5837	0.5974	0.5927	0.5974 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			172.9900			9.0000	1556.9100 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24500.2092 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							298.7830 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1601 (36)
Total fabric heat loss						(33) + (36) =	90.4219 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.0380	40.0043	40.0043	38.7322	39.0389	38.4331	38.4331	38.1416	38.1416	39.0389	38.7322	39.0389 (38)
Heat transfer coeff	131.4598	130.4262	130.4262	129.1541	129.4608	128.8550	128.8550	128.5635	128.5635	129.4608	129.1541	129.4608 (39)
Average = Sum(39)m / 12 =												129.4866 (39)
HLP	1.6032	1.5906	1.5906	1.5750	1.5788	1.5714	1.5714	1.5678	1.5678	1.5788	1.5750	1.5788 (40)
HLP (average)												1.5791 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4997 (42)
Average daily hot water use (litres/day)												93.5682 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.9250	99.1823	95.4396	91.6969	87.9541	84.2114	84.2114	87.9541	91.6969	95.4396	99.1823	102.9250 (44)
Energy conte	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
Energy content (annual)										Total = Sum(45)m =		1472.1924 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.8952	20.0243	20.6633	18.0148	17.2856	14.9162	13.8220	15.8610	16.0504	18.7052	20.4182	22.1728 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8127	26.9017	29.6707	28.5852	29.4448	28.3874	29.2666	29.3821	28.4952	29.5772	28.7719	29.7771 (61)
Total heat required for water heating calculated for each month	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (64)
Heat gains from water heating, kWh/month	58.2043	51.1127	53.2213	47.0790	45.6776	40.1610	37.9554	42.5040	42.7022	48.8575	52.4532	56.5940 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1820.2650 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.8285	44.2572	35.9924	27.2486	20.3686	17.1960	18.5809	24.1522	32.4170	41.1609	48.0408	51.2134 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.6861	337.1487	328.4230	309.8470	286.3982	264.3597	249.6366	246.1740	254.8996	273.4756	296.9244	318.9629 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886 (71)
Water heating gains (Table 5)	78.2316	76.0605	71.5340	65.3876	61.3946	55.7791	51.0154	57.1290	59.3086	65.6686	72.8517	76.0672 (72)
Total internal gains	567.2384	562.9587	541.4417	507.9754	473.6538	442.8272	424.7252	432.9475	452.1175	485.7974	523.3092	551.7358 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	11.4100	13.4684	0.6300	0.7000	0.7700	46.9650 (74)
East	1.3200	25.1733	0.6300	0.7000	0.7700	10.1551 (76)
South	8.0200	56.5862	0.6300	0.7000	0.7700	138.6937 (78)
Solar gains	195.8138	286.8511	412.9155	544.3339	605.0620	681.1449
Total gains	763.0522	849.8098	954.3572	1052.3093	1078.7158	1123.9721
						1049.0071
						1004.1006
						930.1111
						831.1659
						757.5636
						158.4174 (83)
						710.1533 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.7695	52.1798	52.1798	52.6938	52.5689	52.8161	52.8161	52.9358	52.9358	52.5689	52.6938	52.5689
alpha	4.4513	4.4787	4.4787	4.5129	4.5046	4.5211	4.5211	4.5291	4.5291	4.5046	4.5129	4.5046
util living area	0.9919	0.9863	0.9686	0.9150	0.7959	0.5621	0.4013	0.4054	0.7017	0.9233	0.9817	0.9937 (86)
MIT	19.8261	19.9626	20.2362	20.5863	20.8474	20.9763	20.9960	20.9960	20.9373	20.6424	20.2024	19.8150 (87)
Th 2	19.6110	19.6203	19.6203	19.6317	19.6289	19.6344	19.6344	19.6370	19.6370	19.6289	19.6317	19.6289 (88)
util rest of house	0.9883	0.9805	0.9546	0.8764	0.7071	0.4228	0.2373	0.2350	0.5630	0.8769	0.9721	0.9908 (89)
MIT 2	18.6037	18.7452	19.0110	19.3446	19.5522	19.6288	19.6341	19.6368	19.6174	19.4005	18.9916	18.6070 (90)
Living area fraction									fLA = Living area / (4) =			0.3279 (91)
MIT	19.0046	19.1444	19.4128	19.7518	19.9769	20.0707	20.0807	20.0825	20.0502	19.8077	19.3886	19.0031 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0046	19.1444	19.4128	19.7518	19.9769	20.0707	20.0807	20.0825	20.0502	19.8077	19.3886	19.0031 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9862	0.9778	0.9520	0.8805	0.7323	0.4691	0.2916	0.2915	0.6088	0.8844	0.9698	0.9891 (94)
Ext temp.	752.5165	830.9133	908.5171	926.5324	789.9089	527.2622	305.9289	292.6537	566.2483	735.0886	734.6717	702.3782 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	1762.1636	1714.3743	1540.6975	1246.5645	890.2942	537.4144	306.7663	293.4448	597.8465	997.8494	1393.3943	1722.2313 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	751.1775	593.6858	470.3422	230.4231	74.6867	0.0000	0.0000	0.0000	0.0000	195.4940	474.2803	758.7707 (98)
Space heating per m2												3548.8604 (98)
										(98) / (4) =		43.2788 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3925.7305	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	751.1775	593.6858	470.3422	230.4231	74.6867	0.0000	0.0000	0.0000	0.0000	195.4940	474.2803	758.7707	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	830.9486	656.7321	520.2901	254.8928	82.6180	0.0000	0.0000	0.0000	0.0000	216.2545	524.6464	839.3481	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959	(64)
Efficiency of water heater												88.2000	(216)
(217)m	89.9615	89.9229	89.8119	89.5242	88.9369	88.2000	88.2000	88.2000	88.2000	89.4162	89.8220	89.9743	(217)
Fuel for water heating, kWh/month													
	202.8063	178.3718	186.4185	166.0821	162.6795	144.9301	137.6568	153.1994	153.6256	172.5396	183.5775	197.3850	(219)
Water heating fuel used												2039.2722	(219)
Annual totals kWh/year													
Space heating fuel - main system												3925.7305	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												351.9947	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.15 * 1206 * 1.00) =										-1109.5294		-1109.5294	(233)
Total delivered energy for all uses												5282.4680	(238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3925.7305	3.7400	146.8223 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2039.2722	3.7400	76.2688 (247)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	351.9947	20.4300	71.9125 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1109.5294	20.4300	-226.6769 (252)
Total energy cost			178.6493 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3925.7305	0.2160	847.9578 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2039.2722	0.2160	440.4828 (264)
Space and water heating			1288.4406 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	351.9947	0.5190	182.6853 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	0.5190	-575.8458 (269)
Total kg/year			934.2051 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3925.7305	1.2200	4789.3912 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2039.2722	1.2200	2487.9121 (264)
Space and water heating			7277.3033 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	351.9947	3.0700	1080.6238 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	3.0700	-3406.2553 (269)
Primary energy kWh/year			5181.9217 (272)
Primary energy kWh/m2/year			63.1942 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 09 Jan 2014

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 87

(For testing purposes):	
A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Already installed
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 27	-188 kg (20.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£27 2.29 kg/m²	B 88	B 89
Total Savings	£27 2.29 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£87	£97	-£10
Mains gas	£318	£281	£37
Space heating	£257	£257	£0
Water heating	£76	£49	£27
Lighting	£72	£72	£0
Generated (PV)	-£227	-£227	£0
Total cost of fuels	£178	£151	£27
Total cost of uses	£178	£151	£27
Delivered energy	64 kWh/m²	53 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	63 kWh/m²	50 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.0268 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.2525 (8)
Pressure test					Yes
Measured/design AP50					4.2600
Infiltration rate					0.4655 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.4306 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.5490	0.5382	0.5275	0.4736	0.4629	0.4091	0.4091	0.3983	0.4306	0.4629	0.4844	0.5059 (22b)
Effective ac	0.6507	0.6448	0.6391	0.6122	0.6071	0.5837	0.5837	0.5793	0.5927	0.6071	0.6173	0.6280 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1200	1.1000	2.3320		(26)
Windows (Uw = 1.20)			20.7500	1.1450	23.7595		(27)
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600 (28a)
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302 (29a)
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790 (30)
Total net area of external elements Aum(A, m ²)			333.6600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617		(33)
GF Block			84.1400			75.0000	6310.5000 (32c)
GF Stud			25.7100			9.0000	231.3900 (32c)
FF Stud			172.9900			9.0000	1556.9100 (32c)
Internal Floor 1			73.1400			18.0000	1316.5200 (32d)
Internal Ceiling 1			73.1400			18.0000	1316.5200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 24500.2092 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 298.7830 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.1601 (36)
Total fabric heat loss (33) + (36) = 90.4219 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.5221	42.1397	41.7649	40.0043	39.6750	38.1416	38.1416	37.8576	38.7322	39.6750	40.3413	41.0380 (38)
Heat transfer coeff	132.9440	132.5616	132.1868	130.4262	130.0968	128.5635	128.5635	128.2795	129.1541	130.0968	130.7632	131.4598 (39)
Average = Sum(39)m / 12 =												130.4247 (39)
HLP	1.6213	1.6166	1.6120	1.5906	1.5865	1.5678	1.5678	1.5644	1.5750	1.5865	1.5947	1.6032 (40)
HLP (average)												1.5905 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4997 (42)
Average daily hot water use (litres/day)												93.5682 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.9250	99.1823	95.4396	91.6969	87.9541	84.2114	84.2114	87.9541	91.6969	95.4396	99.1823	102.9250 (44)
Energy conte	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
Energy content (annual)										Total = Sum(45)m =		1472.1924 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.8952	20.0243	20.6633	18.0148	17.2856	14.9162	13.8220	15.8610	16.0504	18.7052	20.4182	22.1728 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8127	26.9017	29.6707	28.5852	29.4448	28.3874	29.2666	29.3821	28.4952	29.5772	28.7719	29.7771 (61)
Total heat required for water heating calculated for each month	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2319 (H8)
Utilisation factor												0.5559 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.5682 (H14)
Volume ratio Veff/V												0.8016 (H15)
Solar storage volume factor												0.9558 (H16)
Solar input	-24.5700	-41.0002	-69.8281	-93.5834	-115.6144	-113.6674	-112.1652	-97.9993	-76.7531	-52.4133	-29.1435	-847.2990 (H17)
Solar input (sum of months) = Sum (63)m =												-847.2990 (63)
Output from w/h	157.8776	119.3969	97.5979	55.1003	29.0677	14.1610	9.2481	37.1225	58.7447	101.8651	135.7494	157.0350 (64)
Total per year (kWh/year) = Sum (64)m =												972.9661 (64)
Heat gains from water heating, kWh/month	58.2043	51.1127	53.2213	47.0790	45.6776	40.1610	37.9554	42.5040	42.7022	48.8575	52.4532	56.5940 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.8285	44.2572	35.9924	27.2486	20.3686	17.1960	18.5809	24.1522	32.4170	41.1609	48.0408	51.2134	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.6861	337.1487	328.4230	309.8470	286.3982	264.3597	249.6366	246.1740	254.8996	273.4756	296.9244	318.9629	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	(71)
Water heating gains (Table 5)	78.2316	76.0605	71.5340	65.3876	61.3946	55.7791	51.0154	57.1290	59.3086	65.6686	72.8517	76.0672	(72)
Total internal gains	567.2384	562.9587	541.4417	507.9754	473.6538	442.8272	424.7252	432.9475	452.1175	485.7974	523.3092	551.7358	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				11.4100	10.6334		0.6300		0.7000		0.7700		37.0791 (74)
East				1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South				8.0200	46.7521		0.6300		0.7000		0.7700		114.5901 (78)
Solar gains	159.5922	274.0283	384.9906	500.8200	587.7105	596.5699	569.6026	501.8859	424.1800	305.1594	191.4493	136.4429	(83)
Total gains	726.8306	836.9870	926.4323	1008.7955	1061.3643	1039.3971	994.3277	934.8334	876.2975	790.9568	714.7585	688.1787	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.1916	51.3393	51.4848	52.1798	52.3119	52.9358	52.9358	53.0530	52.6938	52.3119	52.0453	51.7695	
alpha	4.4128	4.4226	4.4323	4.4787	4.4875	4.5291	4.5291	4.5369	4.5129	4.4875	4.4697	4.4513	
util living area	0.9951	0.9903	0.9790	0.9468	0.8670	0.7127	0.5490	0.5999	0.8254	0.9606	0.9906	0.9962	(86)
MIT	19.6175	19.7935	20.0662	20.4220	20.7310	20.9236	20.9815	20.9727	20.8439	20.4493	19.9712	19.5897	(87)
Th 2	19.5978	19.6012	19.6045	19.6203	19.6232	19.6370	19.6370	19.6396	19.6317	19.6232	19.6172	19.6110	(88)
util rest of house	0.9931	0.9863	0.9700	0.9225	0.8056	0.5933	0.3892	0.4382	0.7266	0.9374	0.9860	0.9946	(89)
MIT 2	18.3861	18.5630	18.8335	19.1864	19.4601	19.6082	19.6338	19.6341	19.5594	19.2217	18.7530	18.3688	(90)
Living area fraction									fLA = Living area / (4) =			0.3279	(91)
MIT	18.7899	18.9665	19.2378	19.5916	19.8769	20.0396	20.0757	20.0730	19.9806	19.6243	19.1525	18.7691	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7899	18.9665	19.2378	19.5916	19.8769	20.0396	20.0757	20.0730	19.9806	19.6243	19.1525	18.7691	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9915	0.9838	0.9669	0.9219	0.8187	0.6316	0.4427	0.4926	0.7557	0.9374	0.9838	0.9932	(94)
Useful gains	720.6647	823.4635	895.7400	929.9720	868.9346	656.5257	440.2010	460.4964	662.1982	741.4300	703.2077	683.5307	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1926.3495	1864.6822	1683.7634	1394.4657	1063.7832	699.3328	446.8539	471.1768	759.5085	1174.0318	1576.0244	1915.2549	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	897.0295	699.6990	586.2894	334.4354	144.9673	0.0000	0.0000	0.0000	0.0000	321.8557	628.4280	916.4028	(98)
Space heating												4529.1072	(98)
Space heating per m2											(98) / (4) =	55.2330	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5010.0743	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	897.0295	699.6990	586.2894	334.4354	144.9673	0.0000	0.0000	0.0000	0.0000	321.8557	628.4280	916.4028	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	992.2892	774.0033	648.5502	369.9507	160.3621	0.0000	0.0000	0.0000	0.0000	356.0351	695.1637	1013.7199	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	157.8776	119.3969	97.5979	55.1003	29.0677	14.1610	9.2481	37.1225	58.7447	101.8651	135.7494	157.0350	(64)	
Efficiency of water heater	90.0638	90.0725	90.0793	90.0822	90.0249	88.2000	88.2000	88.2000	88.2000	89.8611	90.0012	90.0713	(217)	
Fuel for water heating, kWh/month	175.2953	132.5564	108.3466	61.1667	32.2885	16.0556	10.4854	42.0890	66.6039	113.3583	150.8307	174.3451	(219)	
Water heating fuel used												1083.4214	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5010.0743	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													351.9947	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.15 * 1080 * 1.00) =										-993.1627		-993.1627	(233)	
Total delivered energy for all uses												5577.3278	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5010.0743	3.4800	174.3506	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1083.4214	3.4800	37.7031	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	351.9947	13.1900	46.4281	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-993.1627	13.1900	-130.9982	(252)
Total energy cost			263.9711	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.8730	(257)
SAP value			87.8220	
SAP rating (Section 12)			88	(258)
SAP band			B	

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

Energy Emission factor Emissions

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	5010.0743	0.2160	1082.1761	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1083.4214	0.2160	234.0190	(264)
Space and water heating			1316.1951	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	351.9947	0.5190	182.6853	(268)
Energy saving/generation technologies				
PV Unit	-993.1627	0.5190	-515.4514	(269)
Total kg/year			1048.3039	(272)
CO2 emissions per m2			12.7800	(273)
EI value			88.9392	
EI rating			89	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	74.6900 (1b)	x 2.3900 (2b)	= 178.5091 (1b) - (3b)
First floor	7.3100 (1c)	x 2.6700 (2c)	= 19.5177 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	82.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.0268 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour							
										heating	heating										
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans																5 * 10 =	50.0000 (7a)				
Number of passive vents																0 * 10 =	0.0000 (7b)				
Number of flueless gas fires																0 * 40 =	0.0000 (7c)				
										Air changes per hour											
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =							50.0000 / (5) =	0.2525 (8)			
Pressure test																	Yes				
Measured/design AP50																	4.2600				
Infiltration rate																	0.4655 (18)				
Number of sides sheltered																	1 (19)				
Shelter factor																	(20) = 1 - [0.075 x (19)] =	0.9250 (20)			
Infiltration rate adjusted to include shelter factor																	(21) = (18) x (20) =	0.4306 (21)			
										Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed										4.7000	4.4000	4.4000	4.0000	4.1000	3.9000	3.9000	3.8000	3.8000	4.1000	4.0000	4.1000 (22)
Wind factor										1.1750	1.1000	1.1000	1.0000	1.0250	0.9750	0.9750	0.9500	0.9500	1.0250	1.0000	1.0250 (22a)
Adj infilt rate										0.5059	0.4736	0.4736	0.4306	0.4413	0.4198	0.4198	0.4091	0.4091	0.4413	0.4306	0.4413 (22b)
Effective ac										0.6280	0.6122	0.6122	0.5927	0.5974	0.5881	0.5881	0.5837	0.5837	0.5974	0.5927	0.5974 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.1200	1.1000	2.3320			(26)					
Windows (Uw = 1.20)			20.7500	1.1450	23.7595			(27)					
Ground Floor			74.6900	0.1200	8.9628	84.0000	6273.9600	(28a)					
Brick and Block	184.2800	22.8700	161.4100	0.2400	38.7384	42.2200	6814.7302	(29a)					
Pitched Roof	74.6900		74.6900	0.1000	7.4690	9.1000	679.6790	(30)					
Total net area of external elements Aum(A, m2)			333.6600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	81.2617			(33)					
GF Block			84.1400			75.0000	6310.5000	(32c)					
GF Stud			25.7100			9.0000	231.3900	(32c)					
FF Stud			172.9900			9.0000	1556.9100	(32c)					
Internal Floor 1			73.1400			18.0000	1316.5200	(32d)					
Internal Ceiling 1			73.1400			18.0000	1316.5200	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24500.2092	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							298.7830	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1601	(36)					
Total fabric heat loss						(33) + (36) =	90.4219	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 41.0380	Feb 40.0043	Mar 40.0043	Apr 38.7322	May 39.0389	Jun 38.4331	Jul 38.4331	Aug 38.1416	Sep 38.1416	Oct 39.0389	Nov 38.7322	Dec 39.0389	(38)
Heat transfer coeff	131.4598	130.4262	130.4262	129.1541	129.4608	128.8550	128.8550	128.5635	128.5635	129.4608	129.1541	129.4608	(39)
Average = Sum(39)m / 12 =												129.4866	(39)
HLP	Jan 1.6032	Feb 1.5906	Mar 1.5906	Apr 1.5750	May 1.5788	Jun 1.5714	Jul 1.5714	Aug 1.5678	Sep 1.5678	Oct 1.5788	Nov 1.5750	Dec 1.5788	(40)
HLP (average)												1.5791	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4997 (42)
Average daily hot water use (litres/day)												93.5682 (43)
Daily hot water use	Jan 102.9250	Feb 99.1823	Mar 95.4396	Apr 91.6969	May 87.9541	Jun 84.2114	Jul 84.2114	Aug 87.9541	Sep 91.6969	Oct 95.4396	Nov 99.1823	Dec 102.9250 (44)
Energy conte	152.6349	133.4954	137.7553	120.0984	115.2373	99.4410	92.1467	105.7397	107.0026	124.7012	136.1211	147.8187 (45)
Energy content (annual)										Total = Sum(45)m =		1472.1924 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	22.8952	20.0243	20.6633	18.0148	17.2856	14.9162	13.8220	15.8610	16.0504	18.7052	20.4182	22.1728 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	29.8127	26.9017	29.6707	28.5852	29.4448	28.3874	29.2666	29.3821	28.4952	29.5772	28.7719	29.7771 (61)
Total heat required for water heating calculated for each month	182.4476	160.3971	167.4260	148.6837	144.6821	127.8284	121.4133	135.1218	135.4978	154.2784	164.8930	177.5959 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1206.0102 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2026.0972 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3762 (H8)
Utilisation factor												0.5165 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.5682 (H14)
Volume ratio Veff/V												0.8016 (H15)
Solar storage volume factor												0.9558 (H16)
Solar input												-879.3805 (H17)
Solar input	-28.6953	-40.8080	-70.8123	-95.2545	-110.6922	-120.4010	-114.1585	-104.1015	-81.4800	-56.3160	-33.9400	-22.7214 (63)
Solar input (sum of months) = Sum (63)m =												-879.3805 (63)
Output from w/h	153.7523	119.5892	96.6137	53.4292	33.9899	7.4274	7.2549	31.0204	54.0178	97.9624	130.9529	154.8745 (64)
Total per year (kWh/year) = Sum (64)m =												940.8845 (64)
Heat gains from water heating, kWh/month	58.2043	51.1127	53.2213	47.0790	45.6776	40.1610	37.9554	42.5040	42.7022	48.8575	52.4532	56.5940 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	149.9829	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.8285	44.2572	35.9924	27.2486	20.3686	17.1960	18.5809	24.1522	32.4170	41.1609	48.0408	51.2134	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.6861	337.1487	328.4230	309.8470	286.3982	264.3597	249.6366	246.1740	254.8996	273.4756	296.9244	318.9629	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	52.4980	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	-99.9886	(71)
Water heating gains (Table 5)	78.2316	76.0605	71.5340	65.3876	61.3946	55.7791	51.0154	57.1290	59.3086	65.6686	72.8517	76.0672	(72)
Total internal gains	567.2384	562.9587	541.4417	507.9754	473.6538	442.8272	424.7252	432.9475	452.1175	485.7974	523.3092	551.7358	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				11.4100	13.4684		0.6300	0.7000	0.7700		46.9650 (74)		
East				1.3200	25.1733		0.6300	0.7000	0.7700		10.1551 (76)		
South				8.0200	56.5862		0.6300	0.7000	0.7700		138.6937 (78)		
Solar gains	195.8138	286.8511	412.9155	544.3339	605.0620	681.1449	624.2819	571.1531	477.9936	345.3685	234.2544	158.4174	(83)
Total gains	763.0522	849.8098	954.3572	1052.3093	1078.7158	1123.9721	1049.0071	1004.1006	930.1111	831.1659	757.5636	710.1533	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.7695	52.1798	52.1798	52.6938	52.5689	52.8161	52.8161	52.9358	52.9358	52.5689	52.6938	52.5689	
alpha	4.4513	4.4787	4.4787	4.5129	4.5046	4.5211	4.5211	4.5291	4.5291	4.5046	4.5129	4.5046	
util living area	0.9919	0.9863	0.9686	0.9150	0.7959	0.5621	0.4013	0.4054	0.7017	0.9233	0.9817	0.9937	(86)
MIT	19.8261	19.9626	20.2362	20.5863	20.8474	20.9763	20.9960	20.9960	20.9373	20.6424	20.2024	19.8150	(87)
Th 2	19.6110	19.6203	19.6203	19.6317	19.6289	19.6344	19.6344	19.6370	19.6370	19.6289	19.6317	19.6289	(88)
util rest of house	0.9883	0.9805	0.9546	0.8764	0.7071	0.4228	0.2373	0.2350	0.5630	0.8769	0.9721	0.9908	(89)
MIT 2	18.6037	18.7452	19.0110	19.3446	19.5522	19.6288	19.6341	19.6368	19.6174	19.4005	18.9916	18.6070	(90)
Living area fraction									fLA = Living area / (4) =			0.3279	(91)
MIT	19.0046	19.1444	19.4128	19.7518	19.9769	20.0707	20.0807	20.0825	20.0502	19.8077	19.3886	19.0031	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0046	19.1444	19.4128	19.7518	19.9769	20.0707	20.0807	20.0825	20.0502	19.8077	19.3886	19.0031	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9862	0.9778	0.9520	0.8805	0.7323	0.4691	0.2916	0.2915	0.6088	0.8844	0.9698	0.9891	(94)
Useful gains	752.5165	830.9133	908.5171	926.5324	789.9089	527.2622	305.9289	292.6537	566.2483	735.0886	734.6717	702.3782	(95)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000	(96)
Heat loss rate W	1762.1636	1714.3743	1540.6975	1246.5645	890.2942	537.4144	306.7663	293.4448	597.8465	997.8494	1393.3943	1722.2313	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	751.1775	593.6858	470.3422	230.4231	74.6867	0.0000	0.0000	0.0000	0.0000	195.4940	474.2803	758.7707	(98)
Space heating												3548.8604	(98)
Space heating per m2												43.2788	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.4000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3925.7305	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	751.1775	593.6858	470.3422	230.4231	74.6867	0.0000	0.0000	0.0000	0.0000	195.4940	474.2803	758.7707	(98)	
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)	
Space heating fuel (main heating system)	830.9486	656.7321	520.2901	254.8928	82.6180	0.0000	0.0000	0.0000	0.0000	216.2545	524.6464	839.3481	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	153.7523	119.5892	96.6137	53.4292	33.9899	7.4274	7.2549	31.0204	54.0178	97.9624	130.9529	154.8745	(64)	
Efficiency of water heater	90.0185	90.0235	90.0174	89.9776	89.7002	88.2000	88.2000	88.2000	88.2000	89.6535	89.9147	90.0194	(217)	
Fuel for water heating, kWh/month	170.8008	132.8422	107.3278	59.3806	37.8928	8.4211	8.2255	35.1705	61.2447	109.2678	145.6413	172.0457	(219)	
Water heating fuel used												1048.2606	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3925.7305	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													351.9947	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.15 * 1206 * 1.00) =										-1109.5294			-1109.5294	(233)
Total delivered energy for all uses													4341.4564	(238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3925.7305	3.7400	146.8223	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1048.2606	3.7400	39.2049	(247)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Pump for solar water heating	50.0000	20.4300	10.2150	(249)
Energy for lighting	351.9947	20.4300	71.9125	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-1109.5294	20.4300	-226.6769	(252)
Total energy cost			151.8004	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3925.7305	0.2160	847.9578	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1048.2606	0.2160	226.4243	(264)
Space and water heating			1074.3821	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	351.9947	0.5190	182.6853	(268)
Energy saving/generation technologies				
PV Unit	-1109.5294	0.5190	-575.8458	(269)
Total kg/year			746.0966	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3925.7305	1.2200	4789.3912 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1048.2606	1.2200	1278.8779 (264)
Space and water heating			6068.2691 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	351.9947	3.0700	1080.6238 (268)
Energy saving/generation technologies			
PV Unit	-1109.5294	3.0700	-3406.2553 (269)
Primary energy kWh/year			4126.3876 (272)
Primary energy kWh/m2/year			50.3218 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 27	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Project	4 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	17.13	TER	22.85
Environmental	87 B	% DER<TER	25.02		
CO ₂ Emissions (t/year)	0.93	DFEE	65.23	TFEE	76.29
General Requirements Compliance	Pass	% DFEE<TFEE	14.49		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
Client	Foreman Homes, FORE		

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Earthwool Loft Roll 40						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Earthwool Loft Roll 40						
	Main construction	200	0.0400	5.0000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Earthwool Loft Roll 40						
	Main construction	100	0.0400	2.5000	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance:	Upper limit = 11.200 m ² K/W	Lower limit = 10.901 m ² K/W	Average = 11.050 m ² K/W
	Total correction = 0.0065 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 463 mm

U-value: 0.10 W/m² K

Kappa: 9.10 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 27	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Project	4 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	17.13	TER	22.85
Environmental	87 B	% DER<TER	25.02		
CO ₂ Emissions (t/year)	0.93	DFEE	65.23	TFEE	76.29
General Requirements Compliance	Pass	% DFEE<TFEE	14.49		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Wall 000001

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Brick, outer leaf						
	Main construction	102	0.7700	0.1325	82.81		
	Main construction	102	0.9407	0.1084	17.19		
Layer 2	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 5	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.321 m ² K/W	Lower limit = 4.110 m ² K/W	Average = 4.215 m ² K/W
	Total correction = 0.0002 m ² K/W	U-value (unrounded) = 0.24 W/m ² K	

Unheated space: None		
Total thickness: 330 mm	U-value: 0.24 W/m² K	Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 27	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Project	4 Winifred Moody Road, West End, Southampton, SO30 3LB		
Calculation Type	New Build (As Built)		

SAP Rating	87 B	DER	17.13	TER	22.85
Environmental	87 B	% DER<TER	25.02		
CO ₂ Emissions (t/year)	0.93	DFEE	65.23	TFEE	76.29
General Requirements Compliance	Pass	% DFEE<TFEE	14.49		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 35.11 m², Perimeter = 16.79 m, Wall thickness = 275.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Concrete, medium density						
	Main construction	100	1.3500	0.0741	100.00		
Layer 2	Polythene, 1000 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 3	Celotex XR4000						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 4	Polythene, 500 gauge						
	Main construction	0.5	0.0000	0.0000	100.00		
Layer 5	Screed						
	Main construction	70	1.1500	0.0609	100.00	1200	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.953 m² K/W Lower limit = 6.953 m² K/W Average = 6.953 m² K/W

Total correction = 0.0096 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 321 mm

U-value: 0.12 W/m² K

Kappa: 84.00 kJ/m² K

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 27	Issued on Date	20/09/2022
Assessment Reference	As Built	Prop Type Ref	Mh
Property	4 Winifred Moody Road, West End, Southampton, SO30 3LB		
SAP Rating	87 B	DER	17.13
Environmental	87 B	TER	22.85
CO ₂ Emissions (t/year)	0.93	% DER<TER	25.02
General Requirements Compliance	Pass	DfEE	65.23
		TFEE	76.29
		% DfEE<TFEE	14.49
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

Orientation	South
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	37.76 m	74.69 m ²
	1st Storey:	35.22 m	7.31 m ²
			2.39 m
			2.67 m

7.0 Living Area	26.89	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	298.78	kJ/m²K

9.0 External Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Brick and Block	Cavity Wall	Other	0.24	42.22	184.28	161.41

9.1 Party Walls			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction			
		Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill		70.00	

9.2 Internal Walls			Kappa (kJ/m ² K)	Area (m ²)
Description	Construction			
GF Block	Dense block, plasterboard on dabs		75.00	84.14
GF Stud	Plasterboard on timber frame		9.00	25.71
FF Stud	Plasterboard on timber frame		9.00	172.99

10.0 External Roofs			U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction				
Pitched Roof	External Plane Roof	Other	0.10	9.10	74.69	74.69

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	73.14

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	74.69

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	73.14

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.12	
Front Shaded	Window	[1] Brick and Block	South	None	0.49	Yes				1.68	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					6.34	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					1.32	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					11.41	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	1.90	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	6.00	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.070	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.58	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.77	0.056	No	Birtley Supatherm
Independently assessed	E3 Sill	10.93	0.021	No	Knauf P5
Independently assessed	E4 Jamb	33.60	0.039	No	Knauf P6
Independently assessed	E5 Ground floor (normal)	37.76	0.105	No	LABC E5MCFF11
Independently assessed	E6 Intermediate floor within a dwelling	35.22	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	18.28	0.060	No	
Independently assessed	E24 Eaves (insulation at ceiling level - inverted)	3.27	0.151	No	Knauf P19
Independently assessed	E12 Gable (insulation at ceiling level)	22.67	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	34.79	0.039	No	Knauf P23
Independently assessed	E17 Corner (inverted – internal area greater than external area)	14.59	-0.091	No	Knauf P24

Y-value 0.027 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀	Yes	
	4.26	m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No
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20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				5
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	28	
Total number of L.E.L. fittings	28	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

0 Main Heating 1	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	18445	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.4	
In Summer	88.2	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.15	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£27	B 88	