



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 5 Haines Crescent, West End
Southampton, SO30 3LG

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
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Report Issue Date: 29/03/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 82			Issued on Date	29/03/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)		
Property	5 Haines Crescent, West End, Southampton, SO30 3LG				
SAP Rating	86 B	DER	14.79	TER	19.09
Environmental	89 B	% DER<TER	22.53		
CO ₂ Emissions (t/year)	0.77	DFEE	44.56	TFEE	52.74
General Requirements Compliance	Pass	% DFEE<TFEE	15.52		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.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)	19.09	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.79	kgCO ₂ /m ²	Pass
	-4.30 (-22.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.74	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.56	kWh/m ² /yr	
	-8.1 (-15.4%)	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	4.15 (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 30Si Compact ErP
Combi boiler
Efficiency: 89.8% 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

Continuous extract system

Specific fan power

0.30

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

3.43 m², No overhang

Windows facing South West

7.49 m², No overhang

Windows facing North West

1.32 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.15 (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
Photovoltaic array	0.64	kW

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THERMAL BRIDGING

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Environmental	89 B	% DER<TER	22.53		
CO ₂ Emissions (t/year)	0.77	DFEE	44.56	TFEE	52.74
General Requirements Compliance	Pass	% DFEE<TFEE	15.52		

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Client	Foreman Homes, FORE
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	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.053	10.13	0.54	CD0025
External wall	E3 Sill	Independently assessed	0.034	7.61	0.26	CD0027
External wall	E4 Jamb	Independently assessed	0.039	27.30	1.06	CD0028
External wall	E5 Ground floor (normal)	Independently assessed	0.060	16.79	1.01	CBA-302
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	16.79	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Table K1 - Approved	0.060	8.41	0.50	CD0033
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.054	8.50	0.46	CD0031
External wall	E16 Corner (normal)	Independently assessed	0.050	10.10	0.51	CD0035
External wall	E18 Party wall between dwellings	Table K1 - Approved	0.060	10.10	0.61	
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.50	1.36	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.50	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Table K1 - Default	0.240	8.50	2.04	

Total: **8.34** W/mK:
Y-Value: **0.054** W/m²K:

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Semi-Detached House, total floor area 70 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) 19.09 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.79 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.7 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 44.6 kWh/m²/yrOK

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: 4.15 (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 30Si Compact ErP

Combi boiler

Efficiency: 89.8% 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

Continuous extract system

Specific fan power: 0.30
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:

Average

Windows facing North East: 3.43 m², No overhang

Windows facing South West: 7.49 m², No overhang

Windows facing North West: 1.32 m², No overhang

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

Photovoltaic array 0.64 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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.6566 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 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					0 * 10 = 0.0000 (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)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1764 (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	0.2249	0.2205	0.2161	0.1940	0.1896	0.1676	0.1676	0.1631	0.1764	0.1896	0.1984	0.2072 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1100	0.1200	4.2132	84.0000	2949.2400 (28a)
Brick and Block	84.9600	14.3600	70.6000	0.2400	16.9440	42.2200	2980.7320 (29a)
Pitched Roof	35.1100		35.1100	0.1000	3.5110	9.1000	319.5010 (30)
Total net area of external elements Aum(A, m ²)			155.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	41.0155			(33)
Party Wall 1			42.9200	0.0000	0.0000	70.0000	3004.4000 (32)
GF Stud			60.0000			9.0000	540.0000 (32c)
First Floor			75.1900			9.0000	676.7100 (32c)
Internal Floor 1			35.1100			18.0000	631.9800 (32d)
Internal Ceiling 1			35.1100			18.0000	631.9800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11734.5430 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.1111 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3423 (36)
Total fabric heat loss						(33) + (36) =	49.3578 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.3133	Feb 29.3133	Mar 29.3133	Apr 29.3133	May 29.3133	Jun 29.3133	Jul 29.3133	Aug 29.3133	Sep 29.3133	Oct 29.3133	Nov 29.3133	Dec 29.3133 (38)
Heat transfer coeff	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711 (39)
Average = Sum(39)m / 12 =												78.6711 (39)
HLP	Jan 1.1204	Feb 1.1204	Mar 1.1204	Apr 1.1204	May 1.1204	Jun 1.1204	Jul 1.1204	Aug 1.1204	Sep 1.1204	Oct 1.1204	Nov 1.1204	Dec 1.1204 (40)
HLP (average)												1.1204 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	96.4392	92.9324	89.4255	85.9186	82.4117	78.9048	78.9048	82.4117	85.9186	89.4255	92.9324	96.4392 (44)
Energy content (annual)	143.0166	125.0832	129.0747	112.5304	107.9756	93.1748	86.3401	99.0766	100.2598	116.8432	127.5435	138.5039 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4525	18.7625	19.3612	16.8796	16.1963	13.9762	12.9510	14.8615	15.0390	17.5265	19.1315	20.7756 (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	31.2121	28.1758	31.1694	30.1354	31.1192	30.0914	31.0795	31.1052	30.1154	31.1486	30.1769	31.2039 (61)
Total heat required for water heating calculated for each month	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078 (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	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078 (64)
Heat gains from water heating, kWh/month	55.3561	48.6341	50.7097	44.9502	43.6817	38.5035	36.4780	40.7193	40.8652	46.6375	49.9524	53.8535 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	18.1079	16.0832	13.0798	9.9022	7.4020	6.2491	6.7524	8.7770	11.7805	14.9580	17.4582	18.6111 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	197.8100	199.8626	194.6900	183.6782	169.7776	156.7131	147.9852	145.9326	151.1052	162.1171	176.0176	189.0821 (68)
Pumps, fans	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573 (69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582 (71)
Total internal gains	74.4033	72.3722	68.1582	62.4309	58.7120	53.4770	49.0295	54.7302	56.7573	62.6848	69.3784	72.3838 (72)
	350.0930	348.0899	335.6998	315.7831	295.6634	276.2111	263.5390	269.2116	279.4147	299.5317	322.6260	339.8488 (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			
Northeast				3.4300	11.2829	0.6300	0.7000	0.7700	11.8274 (75)			
Southwest				7.4900	36.7938	0.6300	0.7000	0.7700	84.2226 (79)			
Northwest				1.3200	11.2829	0.6300	0.7000	0.7700	4.5516 (81)			
Solar gains	100.6016	176.8022	256.3593	341.8634	405.0239	411.8198	392.9912	344.3839	285.7358	199.3004	121.4883	85.4529 (83)
Total gains	450.6946	524.8921	592.0591	657.6464	700.6874	688.0309	656.5302	613.5954	565.1505	498.8321	444.1143	425.3017 (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)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332
util living area	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622
	0.9882	0.9784	0.9573	0.9071	0.8067	0.6535	0.5037	0.5537	0.7738	0.9330	0.9797	0.9904 (86)
MIT	19.4143	19.6250	19.9521	20.3512	20.6962	20.9016	20.9718	20.9595	20.8073	20.3559	19.7978	19.3559 (87)
Th 2	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842 (88)
util rest of house	0.9855	0.9735	0.9475	0.8849	0.7605	0.5733	0.3973	0.4459	0.7051	0.9122	0.9743	0.9883 (89)
MIT 2	18.5423	18.7505	19.0716	19.4547	19.7672	19.9310	19.9744	19.9689	19.8666	19.4671	18.9236	18.4844 (90)
Living area fraction	18.7363	18.9450	19.2674	19.6541	19.9739	20.1469	20.1963	20.1893	20.0758	19.6648	19.1180	18.6782 (92)
MIT	18.7363	18.9450	19.2674	19.6541	19.9739	20.1469	20.1963	20.1893	20.0758	19.6648	19.1180	18.6782 (93)
Temperature adjustment												0.0000
adjusted MIT	18.7363	18.9450	19.2674	19.6541	19.9739	20.1469	20.1963	20.1893	20.0758	19.6648	19.1180	18.6782 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9811	0.9671	0.9389	0.8765	0.7600	0.5870	0.4204	0.4688	0.7120	0.9042	0.9682	0.9845 (94)
Ext temp.	42.1917	507.6450	555.8648	576.3989	532.5039	403.8850	276.0151	287.6325	402.3926	451.0509	430.0064	418.6934 (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	1135.7177	1104.9384	1004.4275	846.0368	650.9151	436.3836	282.9235	298.1080	470.1266	713.1391	945.4712	1139.0180 (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	515.9834	401.3812	333.7307	194.1393	88.0979	0.0000	0.0000	0.0000	0.0000	194.9937	371.1347	535.9215 (98)
Space heating per m2												2635.3824 (98)
												37.5304 (99)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)	90.7000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	2905.6035 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	515.9834	401.3812	333.7307	194.1393	88.0979	0.0000	0.0000	0.0000	0.0000	194.9937	371.1347	535.9215 (98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)
Space heating fuel (main heating system)	568.8902	442.5372	367.9501	214.0455	97.1311	0.0000	0.0000	0.0000	0.0000	214.9875	409.1893	590.8727 (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	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078 (64)
Efficiency of water heater (217)m	89.7366	89.6465	89.4657	89.0950	88.3983	87.0000	87.0000	87.0000	87.0000	89.0656	89.5640	87.0000 (216)
Fuel for water heating, kWh/month	194.1556	170.9593	179.1123	160.1278	157.3500	141.6852	134.9651	149.6342	149.8566	166.1604	176.0979	189.0228 (219)
Water heating fuel used												1969.1273 (219)
Annual totals kWh/year												
Space heating fuel - main system												2905.6035 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.4200)												
mechanical ventilation fans (SFP = 0.4200)												91.0312 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												166.0312 (231)
Electricity for lighting (calculated in Appendix L)												319.7904 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.64 * 1004 * 1.00) =												-514.0461 (233)
Total delivered energy for all uses												4846.5064 (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	2905.6035	0.2160	627.6104 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1969.1273	0.2160	425.3315 (264)
Space and water heating			1052.9419 (265)
Pumps and fans	166.0312	0.5190	86.1702 (267)
Energy for lighting	319.7904	0.5190	165.9712 (268)
Energy saving/generation technologies			
PV Unit	-514.0461	0.5190	-266.7899 (269)
Total CO2, kg/year			1038.2934 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.7900 (273)

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

DER	14.7900	ZC1
Total Floor Area	70.2200	TFA
Assumed number of occupants	2.2515	N
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	EF
CO2 emissions from appliances, equation (L14)	16.6930	ZC2
CO2 emissions from cooking, equation (L16)	2.4642	ZC3
Total CO2 emissions	33.9472	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	33.9472	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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.6566 (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																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) =	0.1689 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4189 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.8500 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3560 (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	0.4539	0.4450	0.4361	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4183	(22b)				
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(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)				12.2400	1.3258	16.2273		(27)				
Ground Floor				35.1100	0.1300	4.5643		(28a)				
Brick and Block	84.9600		14.3600	70.6000	0.1800	12.7080		(29a)				
Pitched Roof	35.1100			35.1100	0.1300	4.5643		(30)				
Total net area of external elements Aum(A, m2)				155.1800				(31)				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.1839		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.1680 (36)				
Total fabric heat loss							(33) + (36) =	49.3519 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.3538	Feb 35.1193	Mar 34.8894	Apr 33.8094	May 33.6074	Jun 32.6668	Jul 32.6668	Aug 32.4927	Sep 33.0291	Oct 33.6074	Nov 34.0161	Dec 34.4435 (38)
Heat transfer coeff	84.7057	84.4711	84.2412	83.1613	82.9593	82.0187	82.0187	81.8445	82.3810	82.9593	83.3680	83.7953 (39)
Average = Sum(39)m / 12 =												83.1604 (39)
HLP	Jan 1.2063	Feb 1.2029	Mar 1.1997	Apr 1.1843	May 1.1814	Jun 1.1680	Jul 1.1680	Aug 1.1655	Sep 1.1732	Oct 1.1814	Nov 1.1872	Dec 1.1933 (40)
HLP (average)												1.1843 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
Daily hot water use	Jan 96.4392	Feb 92.9324	Mar 89.4255	Apr 85.9186	May 82.4117	Jun 78.9048	Jul 78.9048	Aug 82.4117	Sep 85.9186	Oct 89.4255	Nov 92.9324	Dec 96.4392 (44)
Energy conte	143.0166	125.0832	129.0747	112.5304	107.9756	93.1748	86.3401	99.0766	100.2598	116.8432	127.5435	138.5039 (45)
Energy content (annual)										Total = Sum(45)m =		1379.4225 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	21.4525	18.7625	19.3612	16.8796	16.1963	13.9762	12.9510	14.8615	15.0390	17.5265	19.1315	20.7756 (46)
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	49.1444	42.7743	45.5702	42.3708	41.9961	38.9120	40.2090	41.9961	42.3708	45.5702	45.8297	49.1444 (61)
Solar input	192.1610	167.8576	174.6449	154.9013	149.9718	132.0867	126.5492	141.0727	142.6307	162.4134	173.3731	187.6483 (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	192.1610	167.8576	174.6449	154.9013	149.9718	132.0867	126.5492	141.0727	142.6307	162.4134	173.3731	187.6483 (64)
	59.8391	52.2838	54.3099	48.0091	46.4009	40.7086	38.7604	43.4420	43.9291	50.2429	53.8656	58.3387 (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	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1079	16.0832	13.0798	9.9022	7.4020	6.2491	6.7524	8.7770	11.7805	14.9580	17.4582	18.6111	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8100	199.8626	194.6900	183.6782	169.7776	156.7131	147.9852	145.9326	151.1052	162.1171	176.0176	189.0821	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	(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)	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	(71)
Water heating gains (Table 5)	80.4289	77.8032	72.9972	66.6793	62.3668	56.5397	52.0972	58.3898	61.0126	67.5308	74.8134	78.4122	(72)
Total internal gains	356.1186	353.5209	340.5388	320.0315	299.3183	279.2738	266.6067	272.8711	283.6701	304.3777	328.0609	345.8772	(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		
Northeast				3.4300	11.2829	0.6300	0.7000	0.7700		11.8274 (75)		
Southwest				7.4900	36.7938	0.6300	0.7000	0.7700		84.2226 (79)		
Northwest				1.3200	11.2829	0.6300	0.7000	0.7700		4.5516 (81)		
Solar gains	100.6016	176.8022	256.3593	341.8634	405.0239	411.8198	392.9912	344.3839	285.7358	199.3004	121.4883	85.4529 (83)
Total gains	456.7202	530.3231	596.8981	661.8948	704.3423	691.0936	659.5979	617.2550	569.4059	503.6781	449.5493	431.3301 (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	57.5686	57.7285	57.8860	58.6377	58.7805	59.4546	59.4546	59.5811	59.1931	58.7805	58.4923	58.1940	
alpha	4.8379	4.8486	4.8591	4.9092	4.9187	4.9636	4.9636	4.9721	4.9462	4.9187	4.8995	4.8796	
util living area	0.9971	0.9936	0.9840	0.9522	0.8665	0.7017	0.5344	0.5885	0.8311	0.9692	0.9941	0.9978	(86)
MIT	19.7302	19.8965	20.1595	20.5002	20.7856	20.9467	20.9888	20.9823	20.8732	20.5019	20.0542	19.7031	(87)
Th 2	19.9150	19.9176	19.9203	19.9326	19.9349	19.9457	19.9457	19.9477	19.9415	19.9349	19.9302	19.9253	(88)
util rest of house	0.9962	0.9915	0.9783	0.9344	0.8181	0.6085	0.4129	0.4645	0.7551	0.9543	0.9917	0.9971	(89)
MIT 2	18.2325	18.4766	18.8591	19.3505	19.7266	19.9106	19.9416	19.9405	19.8415	19.3627	18.7164	18.2002	(90)
Living area fraction	18.5656	18.7924	19.1484	19.6062	19.9622	20.1411	20.1746	20.1723	20.0710	19.6161	19.0140	18.5345	(92)
MIT	18.5656	18.7924	19.1484	19.6062	19.9622	20.1411	20.1746	20.1723	20.0710	19.6161	19.0140	18.5345	(93)
Temperature adjustment													
adjusted MIT	18.5656	18.7924	19.1484	19.6062	19.9622	20.1411	20.1746	20.1723	20.0710	19.6161	19.0140	18.5345	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9944	0.9882	0.9728	0.9276	0.8195	0.6270	0.4400	0.4921	0.7657	0.9483	0.9886	0.9957	(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	1208.3802	1173.5075	1065.5153	890.3454	685.4254	454.4745	293.1801	308.7388	491.8958	747.9696	993.2480	1201.1631	(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	561.1504	436.4123	360.7492	198.9919	80.4956	0.0000	0.0000	0.0000	0.0000	201.1183	395.1416	574.1483	(98)
Space heating												2808.2076	(98)
Space heating per m2												39.9916	(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													3006.6463 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	561.1504	436.4123	360.7492	198.9919	80.4956	0.0000	0.0000	0.0000	0.0000	201.1183	395.1416	574.1483	(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)	600.8034	467.2508	386.2412	213.0534	86.1837	0.0000	0.0000	0.0000	0.0000	215.3301	423.0638	614.7198	(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	192.1610	167.8576	174.6449	154.9013	149.9718	132.0867	126.5492	141.0727	142.6307	162.4134	173.3731	187.6483	(64)
Efficiency of water heater (217)m	87.5897	87.3481	86.8372	85.6828	83.5608	80.3000	80.3000	80.3000	80.3000	85.5904	87.0606	80.3000	(216)
Fuel for water heating, kWh/month	219.3876	192.1708	201.1177	180.7845	179.4763	164.4916	157.5955	175.6820	177.6222	189.7566	199.1407	214.0067	(219)
Water heating fuel used												2251.2323	(219)
Annual totals kWh/year													
Space heating fuel - main system												3006.6463	(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)												319.7904	(232)
Total delivered energy for all uses												5652.6690	(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	3006.6463	0.2160	649.4356 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2251.2323	0.2160	486.2662 (264)
Space and water heating			1135.7018 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	319.7904	0.5190	165.9712 (268)
Total CO2, kg/m2/year			1340.5980 (272)
Emissions per m2 for space and water heating			16.1735 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3636 (272b)
Emissions per m2 for pumps and fans			0.5543 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1735 * 1.00) + 2.3636 + 0.5543, rounded to 2 d.p.			19.0900 (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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.6566 (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) = 0.1689 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.3764 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3199 (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	0.4079	0.3999	0.3919	0.3519	0.3439	0.3039	0.3039	0.2959	0.3199	0.3439	0.3599	0.3759 (22b)
Effective ac	0.5832	0.5800	0.5768	0.5619	0.5591	0.5462	0.5462	0.5438	0.5512	0.5591	0.5648	0.5706 (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)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1100	0.1200	4.2132	84.0000	2949.2400 (28a)
Brick and Block	84.9600	14.3600	70.6000	0.2400	16.9440	42.2200	2980.7320 (29a)
Pitched Roof	35.1100		35.1100	0.1000	3.5110	9.1000	319.5010 (30)
Total net area of external elements Aum(A, m ²)			155.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.0155		(33)
Party Wall 1			42.9200	0.0000	0.0000	70.0000	3004.4000 (32)
GF Stud			60.0000			9.0000	540.0000 (32c)
First Floor			75.1900			9.0000	676.7100 (32c)
Internal Floor 1			35.1100			18.0000	631.9800 (32d)
Internal Ceiling 1			35.1100			9.0000	315.9900 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 11418.5530 (34)
162.6111 (35)
8.3423 (36)
(33) + (36) = 49.3578 (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	34.1902	34.0008	33.8152	32.9433	32.7802	32.0208	32.0208	31.8802	32.3133	32.7802	33.1102	33.4552 (38)
Heat transfer coeff	83.5480	83.3586	83.1730	82.3011	82.1380	81.3786	81.3786	81.2380	81.6711	82.1380	82.4680	82.8130 (39)
Average = Sum(39)m / 12 =												82.3004 (39)
HLP	1.1898	1.1871	1.1845	1.1720	1.1697	1.1589	1.1589	1.1569	1.1631	1.1697	1.1744	1.1793 (40)
HLP (average)												1.1720 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	96.4392	92.9324	89.4255	85.9186	82.4117	78.9048	78.9048	82.4117	85.9186	89.4255	92.9324	96.4392 (44)
Energy conte	143.0166	125.0832	129.0747	112.5304	107.9756	93.1748	86.3401	99.0766	100.2598	116.8432	127.5435	138.5039 (45)
Energy content (annual)										Total = Sum(45)m =		1379.4225 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	30.3910	26.5802	27.4284	23.9127	22.9448	19.7996	18.3473	21.0538	21.3052	24.8292	27.1030	29.4321 (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	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1079	16.0832	13.0798	9.9022	7.4020	6.2491	6.7524	8.7770	11.7805	14.9580	17.4582	18.6111	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8100	199.8626	194.6900	183.6782	169.7776	156.7131	147.9852	145.9326	151.1052	162.1171	176.0176	189.0821	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	(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)	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	(71)
Water heating gains (Table 5)	40.8482	39.5539	36.8661	33.2121	30.8398	27.4995	24.6603	28.2981	29.5906	33.3725	37.6430	39.5593	(72)
Total internal gains	313.5378	312.2715	301.4077	283.5643	264.7913	247.2335	236.1697	239.7795	249.2480	267.2194	287.8906	304.0243	(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
Northeast				3.4300	11.2829	0.6300	0.7000			0.7700			11.8274 (75)
Southwest				7.4900	36.7938	0.6300	0.7000			0.7700			84.2226 (79)
Northwest				1.3200	11.2829	0.6300	0.7000			0.7700			4.5516 (81)
Solar gains	100.6016	176.8022	256.3593	341.8634	405.0239	411.8198	392.9912	344.3839	285.7358	199.3004	121.4883	85.4529	(83)
Total gains	414.1394	489.0738	557.7670	625.4277	669.8153	659.0534	629.1610	584.1633	534.9838	466.5199	409.3789	389.4772	(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	37.9640	38.0503	38.1352	38.5392	38.6157	38.9761	38.9761	39.0435	38.8365	38.6157	38.4612	38.3010	
alpha	3.5309	3.5367	3.5423	3.5693	3.5744	3.5984	3.5984	3.6029	3.5891	3.5744	3.5641	3.5534	
util living area	0.9903	0.9819	0.9639	0.9197	0.8296	0.6828	0.5342	0.5869	0.8019	0.9443	0.9835	0.9922	(86)
MIT	19.1974	19.4219	19.7754	20.2269	20.6171	20.8694	20.9595	20.9430	20.7522	20.2392	19.6339	19.1565	(87)
Th 2	19.9282	19.9303	19.9324	19.9424	19.9443	19.9530	19.9530	19.9546	19.9497	19.9443	19.9405	19.9366	(88)
util rest of house	0.9881	0.9778	0.9553	0.8997	0.7856	0.6016	0.4213	0.4738	0.7359	0.9263	0.9790	0.9904	(89)
MIT 2	18.2877	18.5118	18.8617	19.3062	19.6667	19.8809	19.9386	19.9325	19.7948	19.3275	18.7316	18.2534	(90)
Living area fraction	18.4901	18.7143	19.0650	19.5110	19.8781	20.1008	20.1657	20.1573	20.0078	19.5303	18.9323	18.4543	(91)
Temperature adjustment	18.4901	18.7143	19.0650	19.5110	19.8781	20.1008	20.1657	20.1573	20.0078	19.5303	18.9323	18.4543	(92)
adjusted MIT	18.4901	18.7143	19.0650	19.5110	19.8781	20.1008	20.1657	20.1573	20.0078	19.5303	18.9323	18.4543	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	407.5113	475.1752	527.9160	556.5186	524.1358	404.6939	280.2370	290.4293	395.9139	427.9693	398.4205	384.3697	(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	1185.5523	1151.5379	1045.0666	873.2999	671.7349	447.6453	290.1723	305.2336	482.4938	733.5159	975.7854	1180.4381	(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	578.8624	454.5157	384.7601	228.0825	109.8137	0.0000	0.0000	0.0000	0.0000	227.3267	415.7027	592.2749	(98)
Space heating												2991.3387	(98)
Space heating per m2												42.5995	(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	764.9592	602.2019	617.4089	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8235	0.8839	0.8584	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	629.9314	532.2571	530.0047	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	854.1596	817.5444	766.3662	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	161.4443	212.2538	175.8530	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												549.5510 (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	40.3611	53.0634	43.9632	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												137.3878 (107)
Space cooling per m2												1.9565 (108)
Energy for space heating												42.5995 (99)
Energy for space cooling												1.9565 (108)
Total												44.5561 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.6 (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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.6566 (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																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) =	0.1689 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4189 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.8500 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3560 (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	0.4539	0.4450	0.4361	0.3916	0.3827	0.3382	0.3382	0.3293	0.3560	0.3827	0.4005	0.4183	(22b)				
Effective ac	0.6030	0.5990	0.5951	0.5767	0.5732	0.5572	0.5572	0.5542	0.5634	0.5732	0.5802	0.5875	(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)				12.2400	1.3258	16.2273		(27)				
Ground Floor				35.1100	0.1300	4.5643		(28a)				
Brick and Block	84.9600		14.3600	70.6000	0.1800	12.7080		(29a)				
Pitched Roof	35.1100			35.1100	0.1300	4.5643		(30)				
Total net area of external elements Aum(A, m2)				155.1800				(31)				
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.1839		(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.1680 (36)				
Total fabric heat loss							(33) + (36) =	49.3519 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.3538	Feb 35.1193	Mar 34.8894	Apr 33.8094	May 33.6074	Jun 32.6668	Jul 32.6668	Aug 32.4927	Sep 33.0291	Oct 33.6074	Nov 34.0161	Dec 34.4435 (38)
Heat transfer coeff	84.7057	84.4711	84.2412	83.1613	82.9593	82.0187	82.0187	81.8445	82.3810	82.9593	83.3680	83.7953 (39)
Average = Sum(39)m / 12 =												83.1604 (39)
HLP	Jan 1.2063	Feb 1.2029	Mar 1.1997	Apr 1.1843	May 1.1814	Jun 1.1680	Jul 1.1680	Aug 1.1655	Sep 1.1732	Oct 1.1814	Nov 1.1872	Dec 1.1933 (40)
HLP (average)												1.1843 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
Daily hot water use	Jan 96.4392	Feb 92.9324	Mar 89.4255	Apr 85.9186	May 82.4117	Jun 78.9048	Jul 78.9048	Aug 82.4117	Sep 85.9186	Oct 89.4255	Nov 92.9324	Dec 96.4392 (44)
Energy conte	143.0166	125.0832	129.0747	112.5304	107.9756	93.1748	86.3401	99.0766	100.2598	116.8432	127.5435	138.5039 (45)
Energy content (annual)										Total = Sum(45)m =		1379.4225 (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												

FULL SAP CALCULATION PRINTOUT

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	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	0.0000 (59)
	30.3910	26.5802	27.4284	23.9127	22.9448	19.7996	18.3473	21.0538	21.3052	24.8292	27.1030	29.4321	(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	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	112.5727	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.1079	16.0832	13.0798	9.9022	7.4020	6.2491	6.7524	8.7770	11.7805	14.9580	17.4582	18.6111	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.8100	199.8626	194.6900	183.6782	169.7776	156.7131	147.9852	145.9326	151.1052	162.1171	176.0176	189.0821	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	34.2573	(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)	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	(71)
Water heating gains (Table 5)	40.8482	39.5539	36.8661	33.2121	30.8398	27.4995	24.6603	28.2981	29.5906	33.3725	37.6430	39.5593	(72)
Total internal gains	313.5378	312.2715	301.4077	283.5643	264.7913	247.2335	236.1697	239.7795	249.2480	267.2194	287.8906	304.0243	(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	
Northeast				3.4300	11.2829	0.6300	0.7000		0.7700			11.8274	(75)
Southwest				7.4900	36.7938	0.6300	0.7000		0.7700			84.2226	(79)
Northwest				1.3200	11.2829	0.6300	0.7000		0.7700			4.5516	(81)

Solar gains	100.6016	176.8022	256.3593	341.8634	405.0239	411.8198	392.9912	344.3839	285.7358	199.3004	121.4883	85.4529	(83)
Total gains	414.1394	489.0738	557.7670	625.4277	669.8153	659.0534	629.1610	584.1633	534.9838	466.5199	409.3789	389.4772	(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)													
tau	57.5686	57.7285	57.8860	58.6377	58.7805	59.4546	59.4546	59.5811	59.1931	58.7805	58.4923	58.1940	
alpha	4.8379	4.8486	4.8591	4.9092	4.9187	4.9636	4.9636	4.9721	4.9462	4.9187	4.8995	4.8796	
util living area	0.9981	0.9955	0.9878	0.9610	0.8840	0.7259	0.5575	0.6167	0.8560	0.9771	0.9960	0.9986	(86)
MIT	19.6745	19.8434	20.1113	20.4614	20.7614	20.9380	20.9865	20.9783	20.8529	20.4588	20.0023	19.6480	(87)
Th 2	19.9150	19.9176	19.9203	19.9326	19.9349	19.9457	19.9457	19.9477	19.9415	19.9349	19.9302	19.9253	(88)
util rest of house	0.9975	0.9939	0.9834	0.9459	0.8391	0.6330	0.4321	0.4892	0.7849	0.9654	0.9944	0.9982	(89)
MIT 2	18.7108	18.8811	19.1488	19.4994	19.7739	19.9173	19.9423	19.9415	19.8599	19.5040	19.0501	18.6926	(90)
Living area fraction									fLA = Living area / (4) =			0.2224	(91)
MIT	18.9252	19.0952	19.3629	19.7134	19.9935	20.1443	20.1746	20.1722	20.0808	19.7164	19.2619	18.9052	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9252	19.0952	19.3629	19.7134	19.9935	20.1443	20.1746	20.1722	20.0808	19.7164	19.2619	18.9052	(93)

8. Space heating requirement													

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9967	0.9923	0.9803	0.9420	0.8420	0.6519	0.4603	0.5178	0.7958	0.9622	0.9930	0.9975	(94)
Ext temp.	412.7624	485.3094	546.8026	589.1541	563.9786	429.6493	289.6070	302.4832	425.7579	448.9069	406.4960	388.5108	(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	1238.8358	1199.0840	1083.5845	899.2553	688.0250	454.7403	293.1815	308.7316	492.7010	756.2880	1013.9116	1232.2242	(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	614.5986	479.6565	399.3657	223.2729	92.2906	0.0000	0.0000	0.0000	0.0000	228.6916	437.3392	627.7228	(98)
Space heating												3102.9380	(98)
Space heating per m2										(98) / (4) =		44.1888	(99)

8c. Space cooling requirement													

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	770.9759	606.9385	622.0185	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8719	0.9293	0.9063	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	672.2236	564.0344	563.7551	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	854.1596	817.5444	766.3662	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	130.9939	188.6115	150.7427	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												470.3481	(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	32.7485	47.1529	37.6857	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												117.5870 (107)
Space cooling per m2												1.6746 (108)
Energy for space heating												44.1888 (99)
Energy for space cooling												1.6746 (108)
Total												45.8634 (109)
Target Fabric Energy Efficiency (TFEE)												52.7 (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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.6566 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1764 (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	0.2072	0.1940	0.1940	0.1764	0.1808	0.1720	0.1720	0.1676	0.1676	0.1808	0.1764	0.1808 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1100	0.1200	4.2132	84.0000	2949.2400 (28a)
Brick and Block	84.9600	14.3600	70.6000	0.2400	16.9440	42.2200	2980.7320 (29a)
Pitched Roof	35.1100		35.1100	0.1000	3.5110	9.1000	319.5010 (30)
Total net area of external elements Aum(A, m ²)			155.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0155		(33)
Party Wall 1			42.9200	0.0000	0.0000	70.0000	3004.4000 (32)
GF Stud			60.0000			9.0000	540.0000 (32c)
First Floor			75.1900			9.0000	676.7100 (32c)
Internal Floor 1			35.1100			18.0000	631.9800 (32d)
Internal Ceiling 1			35.1100			18.0000	631.9800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11734.5430 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.1111 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3423 (36)
Total fabric heat loss						(33) + (36) =	49.3578 (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	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133 (38)
Average = Sum(39)m / 12 =	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711 (39)
	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	96.4392	92.9324	89.4255	85.9186	82.4117	78.9048	78.9048	82.4117	85.9186	89.4255	92.9324	96.4392 (44)
Energy content (annual)	143.0166	125.0832	129.0747	112.5304	107.9756	93.1748	86.3401	99.0766	100.2598	116.8432	127.5435	138.5039 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4525	18.7625	19.3612	16.8796	16.1963	13.9762	12.9510	14.8615	15.0390	17.5265	19.1315	1379.4225 (45)
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	31.2121	28.1758	31.1694	30.1354	31.1192	30.0914	31.0795	31.1052	30.1154	31.1486	30.1769	31.2039 (61)
Total heat required for water heating calculated for each month	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078 (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	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078 (64)
RHI water heating demand	55.3561	48.6341	50.7097	44.9502	43.6817	38.5035	36.4780	40.7193	40.8652	46.6375	49.9524	53.8535 (65)
Heat gains from water heating, kWh/month												1746 (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	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2696	40.2081	32.6994	24.7556	18.5051	15.6228	16.8809	21.9425	29.4512	37.3950	43.6455	46.5278 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.2388	298.3024	290.5821	274.1465	253.3995	233.9002	220.8735	217.8098	225.5301	241.9658	262.7128	282.2121 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602 (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)	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582 (71)
Water heating gains (Table 5)	74.4033	72.3722	68.1582	62.4309	58.7120	53.4770	49.0295	54.7302	56.7573	62.6848	69.3784	72.3838 (72)
Total internal gains	513.7010	509.6720	490.2290	460.1222	429.4058	401.7892	385.5732	393.2718	410.5278	440.8349	474.5259	499.9129 (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
Northeast				3.4300	14.6130	0.6300	0.7000			0.7700			15.3182 (75)
Southwest				7.4900	45.0642	0.6300	0.7000			0.7700			103.1538 (79)
Northwest				1.3200	14.6130	0.6300	0.7000			0.7700			5.8950 (81)
Solar gains	124.3670	186.5151	276.7759	372.9316	417.4858	470.3403	431.0043	392.9134	323.7827	227.2687	149.7944	99.9469	(83)
Total gains	638.0680	696.1871	767.0049	833.0538	846.8916	872.1295	816.5776	786.1852	734.3106	668.1036	624.3204	599.8598	(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	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332
alpha	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622
util living area	0.9555	0.9387	0.8945	0.8013	0.6548	0.4463	0.3150	0.3172	0.5615	0.8081	0.9237	0.9621 (86)
MIT	19.9010	20.0386	20.3278	20.6531	20.8777	20.9781	20.9956	20.9957	20.9484	20.7074	20.2718	19.8560 (87)
Th 2	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842 (88)
util rest of house	0.9459	0.9260	0.8728	0.7620	0.5908	0.3629	0.2195	0.2180	0.4733	0.7597	0.9050	0.9537 (89)
MIT 2	19.0201	19.1525	19.4276	19.7235	19.9090	19.9755	19.9834	19.9834	19.9603	19.7785	19.3806	18.9770 (90)
Living area fraction									fLA = Living area / (4) =			0.2224 (91)
MIT	19.2161	19.3496	19.6278	19.9302	20.1245	20.1985	20.2086	20.2086	20.1801	19.9851	19.5789	19.1725 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2161	19.3496	19.6278	19.9302	20.1245	20.1985	20.2086	20.2086	20.1801	19.9851	19.5789	19.1725 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9371	0.9164	0.8640	0.7597	0.6002	0.3810	0.2408	0.2402	0.4911	0.7598	0.8961	0.9454 (94)
Ext temp.	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	18.8064	360.6240	507.5984	559.4681	567.0967 (95)
Heat loss rate W	1071.1906	1050.2313	946.2446	773.3565	552.6227	338.1714	197.3510	189.4879	376.0585	620.3302	863.7206	1059.8981 (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	352.1095	277.0172	210.9509	101.1556	32.9883	0.0000	0.0000	0.0000	0.0000	83.8724	219.0618	366.6443 (98)
Space heating												1643.8000 (98)
RHI space heating demand												1644 (98)

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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.6566 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.1764 (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	0.2249	0.2205	0.2161	0.1940	0.1896	0.1676	0.1676	0.1631	0.1764	0.1896	0.1984	0.2072 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1100	0.1200	4.2132	84.0000	2949.2400 (28a)
Brick and Block	84.9600	14.3600	70.6000	0.2400	16.9440	42.2200	2980.7320 (29a)
Pitched Roof	35.1100		35.1100	0.1000	3.5110	9.1000	319.5010 (30)
Total net area of external elements Aum(A, m ²)			155.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.0155		(33)
Party Wall 1			42.9200	0.0000	0.0000	70.0000	3004.4000 (32)
GF Stud			60.0000			9.0000	540.0000 (32c)
First Floor			75.1900			9.0000	676.7100 (32c)
Internal Floor 1			35.1100			18.0000	631.9800 (32d)
Internal Ceiling 1			35.1100			18.0000	631.9800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11734.5430 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.1111 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3423 (36)
Total fabric heat loss						(33) + (36) =	49.3578 (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	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133 (38)
Average = Sum(39)m / 12 =	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711 (39)
	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

Page 24 of 45

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2318.3862 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	424.5308	325.4068	263.4286	146.4045	62.0960	0.0000	0.0000	0.0000	0.0000	141.4594	294.7312	444.7190	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	468.0604	358.7726	290.4395	161.4162	68.4631	0.0000	0.0000	0.0000	0.0000	155.9641	324.9517	490.3186	(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	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078	(64)
Efficiency of water heater	89.5913	89.4815	89.2641	88.8354	88.1094	87.0000	87.0000	87.0000	87.0000	88.7698	89.3750	89.6469	(216)
(217)m	89.5913	89.4815	89.2641	88.8354	88.1094	87.0000	87.0000	87.0000	87.0000	88.7698	89.3750	89.6469	(217)
Fuel for water heating, kWh/month	194.4706	171.2744	179.5168	160.5957	157.8661	141.6852	134.9651	149.6342	149.8566	166.7142	176.4703	189.3069	(219)
Water heating fuel used	194.4706	171.2744	179.5168	160.5957	157.8661	141.6852	134.9651	149.6342	149.8566	166.7142	176.4703	189.3069	(219)
Annual totals kWh/year												1972.3562	(219)
Space heating fuel - main system												2318.3862	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.4200)													
mechanical ventilation fans (SFP = 0.4200)												91.0312	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												166.0312	(231)
Electricity for lighting (calculated in Appendix L)												319.7904	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1004 * 1.00) =										-514.0461		-514.0461	(233)
Total delivered energy for all uses												4262.5180	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2318.3862	3.4800	80.6798 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1972.3562	3.4800	68.6380 (247)
Mechanical ventilation fans	91.0312	13.1900	12.0070 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	319.7904	13.1900	42.1804 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-514.0461	13.1900	-67.8027 (252)
Total energy cost			265.5950 (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] =	0.9681 (257)
SAP value	86.4943	
SAP rating (Section 12)	86	(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	2318.3862	0.2160	500.7714 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1972.3562	0.2160	426.0289 (264)
Space and water heating			926.8004 (265)
Pumps and fans	166.0312	0.5190	86.1702 (267)
Energy for lighting	319.7904	0.5190	165.9712 (268)
Energy saving/generation technologies			
PV Unit	-514.0461	0.5190	-266.7899 (269)
Total kg/year			912.1519 (272)
CO2 emissions per m2			12.9900 (273)
EI value			89.3917
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8842 = 3.936$, stars = 4
Water heating environmental impact	$0.216 / 0.8842 = 0.2443$, 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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.6566 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 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					0 * 10 = 0.0000 (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)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1764 (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	0.2072	0.1940	0.1940	0.1764	0.1808	0.1720	0.1720	0.1676	0.1676	0.1808	0.1764	0.1808 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1100	0.1200	4.2132	84.0000	2949.2400 (28a)
Brick and Block	84.9600	14.3600	70.6000	0.2400	16.9440	42.2200	2980.7320 (29a)
Pitched Roof	35.1100		35.1100	0.1000	3.5110	9.1000	319.5010 (30)
Total net area of external elements Aum(A, m ²)			155.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	41.0155			(33)
Party Wall 1			42.9200	0.0000	0.0000	70.0000	3004.4000 (32)
GF Stud			60.0000			9.0000	540.0000 (32c)
First Floor			75.1900			9.0000	676.7100 (32c)
Internal Floor 1			35.1100			18.0000	631.9800 (32d)
Internal Ceiling 1			35.1100			18.0000	631.9800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11734.5430 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.1111 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3423 (36)
Total fabric heat loss						(33) + (36) =	49.3578 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.3133	Feb 29.3133	Mar 29.3133	Apr 29.3133	May 29.3133	Jun 29.3133	Jul 29.3133	Aug 29.3133	Sep 29.3133	Oct 29.3133	Nov 29.3133	Dec 29.3133 (38)
Heat transfer coeff	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711 (39)
Average = Sum(39)m / 12 =												78.6711 (39)
HLP	Jan 1.1204	Feb 1.1204	Mar 1.1204	Apr 1.1204	May 1.1204	Jun 1.1204	Jul 1.1204	Aug 1.1204	Sep 1.1204	Oct 1.1204	Nov 1.1204	Dec 1.1204 (40)
HLP (average)												1.1204 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

Energy conte	96.4392	92.9324	89.4255	85.9186	82.4117	78.9048	78.9048	82.4117	85.9186	89.4255	92.9324	96.4392	(44)
Energy content (annual)	143.0166	125.0832	129.0747	112.5304	107.9756	13.1748	86.3401	99.0766	100.2598	116.8432	127.5435	138.5039	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1379.4225	(45)
	21.4525	18.7625	19.3612	16.8796	16.1963	13.9762	12.9510	14.8615	15.0390	17.5265	19.1315	20.7756	(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	31.2121	28.1758	31.1694	30.1354	31.1192	30.0914	31.0795	31.1052	30.1154	31.1486	30.1769	31.2039	(61)
Total heat required for water heating calculated for each month													
	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078	(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													
	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078	(64)
								Total per year (kWh/year) = Sum(64)m =				1746.1553	(64)
Heat gains from water heating, kWh/month													
	55.3561	48.6341	50.7097	44.9502	43.6817	38.5035	36.4780	40.7193	40.8652	46.6375	49.9524	53.8535	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2696	40.2081	32.6994	24.7556	18.5051	15.6228	16.8809	21.9425	29.4512	37.3950	43.6455	46.5278 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.2388	298.3024	290.5821	274.1465	253.3995	233.9002	220.8735	217.8098	225.5301	241.9658	262.7128	282.2121 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602 (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)	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582 (71)
Water heating gains (Table 5)	74.4033	72.3722	68.1582	62.4309	58.7120	53.4770	49.0295	54.7302	56.7573	62.6848	69.3784	72.3838 (72)
Total internal gains	513.7010	509.6720	490.2290	460.1222	429.4058	401.7892	385.5732	393.2718	410.5278	440.8349	474.5259	499.9129 (73)

[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
Northeast	3.4300	14.6130	0.6300	0.7000	0.7700	15.3182 (75)
Southwest	7.4900	45.0642	0.6300	0.7000	0.7700	103.1538 (79)
Northwest	1.3200	14.6130	0.6300	0.7000	0.7700	5.8950 (81)

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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 %)													90.7000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1812.3484 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	352.1095	277.0172	210.9509	101.1556	32.9883	0.0000	0.0000	0.0000	0.0000	83.8724	219.0618	366.6443	(98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)
Space heating fuel (main heating system)	388.2133	305.4214	232.5809	111.5276	36.3708	0.0000	0.0000	0.0000	0.0000	92.4724	241.5235	404.2384	(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	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078	(64)
Efficiency of water heater	89.4409	89.3466	89.0648	88.4978	87.6857	87.0000	87.0000	87.0000	87.0000	88.3030	89.1136	89.4957	(216)
(217)m													(217)
Fuel for water heating, kWh/month	194.7977	171.5332	179.9185	161.2084	158.6288	141.6852	134.9651	149.6342	149.8566	167.5954	176.9881	189.6268	(219)
Water heating fuel used												1976.4381	(219)
Annual totals kWh/year													
Space heating fuel - main system												1812.3484	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.4200)													
mechanical ventilation fans (SFP = 0.4200)												91.0312	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												166.0312	(231)
Electricity for lighting (calculated in Appendix L)												319.7904	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.64 * 1120 * 1.00) =										-573.3580		-573.3580	(233)
Total delivered energy for all uses												3701.2501	(238)

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1812.3484	3.6300	65.7882 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1976.4381	3.6300	71.7447 (247)
Mechanical ventilation fans	91.0312	19.4400	17.6965 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	319.7904	19.4400	62.1673 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-573.3580	19.4400	-111.4608 (252)
Total energy cost			215.5159 (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	1812.3484	0.2160	391.4672 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1976.4381	0.2160	426.9106 (264)
Space and water heating			818.3779 (265)
Pumps and fans	166.0312	0.5190	86.1702 (267)
Energy for lighting	319.7904	0.5190	165.9712 (268)
Energy saving/generation technologies			
PV Unit	-573.3580	0.5190	-297.5728 (269)
Total kg/year			772.9465 (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	1812.3484	1.2200	2211.0650 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1976.4381	1.2200	2411.2544 (264)
Space and water heating			4622.3194 (265)
Pumps and fans	166.0312	3.0700	509.7159 (267)
Energy for lighting	319.7904	3.0700	981.7567 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-573.3580	3.0700	-1760.2090 (269)
Primary energy kWh/year			4353.5830 (272)
Primary energy kWh/m2/year			61.9992 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 86
Current environmental impact rating:	B 89

(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	+ 1.3	-£ 26	-184 kg (23.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£26 2.63 kg/m²	B 88	B 91
Total Savings	£26 2.63 kg/m²		

Potential energy efficiency rating:	B 88
Potential environmental impact rating:	B 91

Fuel prices for cost data on this page from database revision number 491 TEST (28 Feb 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	£94	£104	-£10
Mains gas	£233	£197	£35
Space heating	£193	£193	£0
Water heating	£72	£46	£26
Lighting	£62	£62	£0
Generated (PV)	-£111	-£111	£0
Total cost of fuels	£216	£190	£25
Total cost of uses	£216	£190	£26
Delivered energy	53 kWh/m²	40 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	62 kWh/m²	47 kWh/m²	15 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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 177.6566 (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					0 * 10 = 0.0000 (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)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.1500
Infiltration rate					0.2075 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.1764 (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	0.2249	0.2205	0.2161	0.1940	0.1896	0.1676	0.1676	0.1631	0.1764	0.1896	0.1984	0.2072 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1100	0.1200	4.2132	84.0000	2949.2400 (28a)
Brick and Block	84.9600	14.3600	70.6000	0.2400	16.9440	42.2200	2980.7320 (29a)
Pitched Roof	35.1100		35.1100	0.1000	3.5110	9.1000	319.5010 (30)
Total net area of external elements Aum(A, m ²)			155.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	41.0155			(33)
Party Wall 1			42.9200	0.0000	0.0000	70.0000	3004.4000 (32)
GF Stud			60.0000			9.0000	540.0000 (32c)
First Floor			75.1900			9.0000	676.7100 (32c)
Internal Floor 1			35.1100			18.0000	631.9800 (32d)
Internal Ceiling 1			35.1100			18.0000	631.9800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11734.5430 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.1111 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3423 (36)
Total fabric heat loss						(33) + (36) =	49.3578 (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	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133 (38)
Average = Sum(39)m / 12 =	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711 (39)
HLP	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204	1.1204 (40)
HLP (average)												1.1204 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	96.4392	92.9324	89.4255	85.9186	82.4117	78.9048	78.9048	82.4117	85.9186	89.4255	92.9324	96.4392 (44)
Energy content (annual)	143.0166	125.0832	129.0747	112.5304	107.9756	93.1748	86.3401	99.0766	100.2598	116.8432	127.5435	138.5039 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1379.4225 (45)
	21.4525	18.7625	19.3612	16.8796	16.1963	13.9762	12.9510	14.8615	15.0390	17.5265	19.1315	20.7756 (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	31.2121	28.1758	31.1694	30.1354	31.1192	30.0914	31.0795	31.1052	30.1154	31.1486	30.1769	31.2039 (61)
Total heat required for water heating calculated for each month	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078 (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												1.3148 (H8)
Utilisation factor												0.5326 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6720 (H14)
Volume ratio Veff/V												0.8555 (H15)
Solar storage volume factor												0.9688 (H16)
Solar input	-23.8605	-39.8163	-67.8118	-90.8811	-112.2760	-110.3852	-108.9264	-95.1695	-74.5368	-50.8999	-28.3020	-822.8328 (H17)
Solar input (sum of months) = Sum (63)m =												-19.9672 (63)
Output from w/h	150.3682	113.4427	92.4323	51.7847	26.8188	12.8810	8.4933	35.0122	55.8384	97.0919	129.4184	149.7406 (64)
Total per year (kWh/year) = Sum (64)m =												923.3225 (64)
Heat gains from water heating, kWh/month	55.3561	48.6341	50.7097	44.9502	43.6817	38.5035	36.4780	40.7193	40.8652	46.6375	49.9524	53.8535 (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	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2696	40.2081	32.6994	24.7556	18.5051	15.6228	16.8809	21.9425	29.4512	37.3950	43.6455	46.5278	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.2388	298.3024	290.5821	274.1465	253.3995	233.9002	220.8735	217.8098	225.5301	241.9658	262.7128	282.2121	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	(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)	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	(71)
Water heating gains (Table 5)	74.4033	72.3722	68.1582	62.4309	58.7120	53.4770	49.0295	54.7302	56.7573	62.6848	69.3784	72.3838	(72)
Total internal gains	513.7010	509.6720	490.2290	460.1222	429.4058	401.7892	385.5732	393.2718	410.5278	440.8349	474.5259	499.9129	(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
Northeast	3.4300	11.2829	0.6300	0.7000	0.7700	11.8274 (75)
Southwest	7.4900	36.7938	0.6300	0.7000	0.7700	84.2226 (79)
Northwest	1.3200	11.2829	0.6300	0.7000	0.7700	4.5516 (81)

Solar gains	100.6016	176.8022	256.3593	341.8634	405.0239	411.8198	392.9912	344.3839	285.7358	199.3004	121.4883	85.4529 (83)
Total gains	614.3026	686.4742	746.5883	801.9856	834.4297	813.6091	778.5645	737.6556	696.2636	640.1353	596.0142	585.3659 (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)													
tau	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	
alpha	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	
util living area	0.9687	0.9517	0.9191	0.8518	0.7353	0.5757	0.4327	0.4728	0.6827	0.8746	0.9509	0.9734	(86)
MIT	19.6876	19.8802	20.1701	20.5093	20.7843	20.9359	20.9830	20.9761	20.8767	20.5283	20.0381	19.6272	(87)
Th 2	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	(88)
util rest of house	0.9622	0.9420	0.9027	0.8217	0.6835	0.4982	0.3380	0.3759	0.6089	0.8423	0.9393	0.9679	(89)
MIT 2	18.8106	18.9981	19.2779	19.5954	19.8356	19.9509	19.9786	19.9756	19.9131	19.6208	19.1557	18.7514	(90)
Living area fraction									fLA = Living area / (4) =			0.2224	(91)
MIT	19.0057	19.1943	19.4764	19.7987	20.0466	20.1700	20.2020	20.1982	20.1274	19.8227	19.3520	18.9462	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0057	19.1943	19.4764	19.7987	20.0466	20.1700	20.2020	20.1982	20.1274	19.8227	19.3520	18.9462	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	2318.3862	0.2160	500.7714 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1034.0902	0.2160	223.3635 (264)
Space and water heating			724.1349 (265)
Pumps and fans	216.0312	0.5190	112.1202 (267)
Energy for lighting	319.7904	0.5190	165.9712 (268)
Energy saving/generation technologies			
PV Unit	-514.0461	0.5190	-266.7899 (269)
Total kg/year			735.4365 (272)
CO2 emissions per m2			10.4700 (273)
EI value			91.4469
EI rating			91 (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	35.1100 (1b)	x 2.3900 (2b)	= 83.9129 (1b) - (3b)
First floor	35.1100 (1c)	x 2.6700 (2c)	= 93.7437 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.2200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	177.6566 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
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											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.1500
Infiltration rate												0.2075 (18)
Number of sides sheltered												2 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1764 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2072	0.1940	0.1940	0.1764	0.1808	0.1720	0.1720	0.1676	0.1676	0.1808	0.1764	0.1808 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			12.2400	1.1450	14.0153		(27)
Ground Floor			35.1100	0.1200	4.2132	84.0000	2949.2400 (28a)
Brick and Block	84.9600	14.3600	70.6000	0.2400	16.9440	42.2200	2980.7320 (29a)
Pitched Roof	35.1100		35.1100	0.1000	3.5110	9.1000	319.5010 (30)
Total net area of external elements Aum(A, m ²)			155.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	41.0155			(33)
Party Wall 1			42.9200	0.0000	0.0000	70.0000	3004.4000 (32)
GF Stud			60.0000			9.0000	540.0000 (32c)
First Floor			75.1900			9.0000	676.7100 (32c)
Internal Floor 1			35.1100			18.0000	631.9800 (32d)
Internal Ceiling 1			35.1100			18.0000	631.9800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11734.5430 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							167.1111 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3423 (36)
Total fabric heat loss						(33) + (36) =	49.3578 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.3133	Feb 29.3133	Mar 29.3133	Apr 29.3133	May 29.3133	Jun 29.3133	Jul 29.3133	Aug 29.3133	Sep 29.3133	Oct 29.3133	Nov 29.3133	Dec 29.3133 (38)
Heat transfer coeff	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711	78.6711 (39)
Average = Sum(39)m / 12 =												78.6711 (39)
HLP	Jan 1.1204	Feb 1.1204	Mar 1.1204	Apr 1.1204	May 1.1204	Jun 1.1204	Jul 1.1204	Aug 1.1204	Sep 1.1204	Oct 1.1204	Nov 1.1204	Dec 1.1204 (40)
HLP (average)												1.1204 (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												2.2515 (42)
Average daily hot water use (litres/day)												87.6720 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	96.4392	92.9324	89.4255	85.9186	82.4117	78.9048	78.9048	82.4117	85.9186	89.4255	92.9324	96.4392 (44)
Energy content (annual)	143.0166	125.0832	129.0747	112.5304	107.9756	93.1748	86.3401	99.0766	100.2598	116.8432	127.5435	138.5039 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1379.4225 (45)
	21.4525	18.7625	19.3612	16.8796	16.1963	13.9762	12.9510	14.8615	15.0390	17.5265	19.1315	20.7756 (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	31.2121	28.1758	31.1694	30.1354	31.1192	30.0914	31.0795	31.1052	30.1154	31.1486	30.1769	31.2039 (61)
Total heat required for water heating calculated for each month	174.2288	153.2590	160.2441	142.6658	139.0948	123.2662	117.4197	130.1818	130.3752	147.9918	157.7204	169.7078 (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												1.4688 (H8)
Utilisation factor												0.4938 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6720 (H14)
Volume ratio Veff/V												0.8555 (H15)
Solar storage volume factor												0.9688 (H16)
Solar input	-27.8102	-39.5493	-68.6282	-92.3165	-107.2780	-116.6874	-110.6374	-100.8906	-78.9669	-54.5791	-32.8932	-852.2574 (H17)
Solar input (sum of months) = Sum (63)m =												-852.2574 (63)
Output from w/h	146.4185	113.7097	91.6159	50.3493	31.8168	6.5788	6.7822	29.2912	51.4084	93.4127	124.8272	147.6872 (64)
Total per year (kWh/year) = Sum (64)m =												893.8979 (64)
Heat gains from water heating, kWh/month	55.3561	48.6341	50.7097	44.9502	43.6817	38.5035	36.4780	40.7193	40.8652	46.6375	49.9524	53.8535 (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	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	135.0872	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.2696	40.2081	32.6994	24.7556	18.5051	15.6228	16.8809	21.9425	29.4512	37.3950	43.6455	46.5278	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.2388	298.3024	290.5821	274.1465	253.3995	233.9002	220.8735	217.8098	225.5301	241.9658	262.7128	282.2121	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	50.7602	(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)	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	-90.0582	(71)
Water heating gains (Table 5)	74.4033	72.3722	68.1582	62.4309	58.7120	53.4770	49.0295	54.7302	56.7573	62.6848	69.3784	72.3838	(72)
Total internal gains	513.7010	509.6720	490.2290	460.1222	429.4058	401.7892	385.5732	393.2718	410.5278	440.8349	474.5259	499.9129	(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
Northeast				3.4300	14.6130		0.6300		0.7000		0.7700		15.3182 (75)
Southwest				7.4900	45.0642		0.6300		0.7000		0.7700		103.1538 (79)
Northwest				1.3200	14.6130		0.6300		0.7000		0.7700		5.8950 (81)
Solar gains	124.3670	186.5151	276.7759	372.9316	417.4858	470.3403	431.0043	392.9134	323.7827	227.2687	149.7944	99.9469	(83)
Total gains	638.0680	696.1871	767.0049	833.0538	846.8916	872.1295	816.5776	786.1852	734.3106	668.1036	624.3204	599.8598	(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	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	41.4332	
alpha	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	3.7622	
util living area	0.9555	0.9387	0.8945	0.8013	0.6548	0.4463	0.3150	0.3172	0.5615	0.8081	0.9237	0.9621	(86)
MIT	19.9010	20.0386	20.3278	20.6531	20.8777	20.9781	20.9956	20.9957	20.9484	20.7074	20.2718	19.8560	(87)
Th 2	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	19.9842	(88)
util rest of house	0.9459	0.9260	0.8728	0.7620	0.5908	0.3629	0.2195	0.2180	0.4733	0.7597	0.9050	0.9537	(89)
MIT 2	19.0201	19.1525	19.4276	19.7235	19.9090	19.9755	19.9834	19.9834	19.9603	19.7785	19.3806	18.9770	(90)
Living area fraction									fLA = Living area / (4) =			0.2224	(91)
MIT	19.2161	19.3496	19.6278	19.9302	20.1245	20.1985	20.2086	20.2086	20.1801	19.9851	19.5789	19.1725	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.2161	19.3496	19.6278	19.9302	20.1245	20.1985	20.2086	20.2086	20.1801	19.9851	19.5789	19.1725	(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	0.9371	0.9164	0.8640	0.7597	0.6002	0.3810	0.2408	0.2402	0.4911	0.7598	0.8961	0.9454	(94)
Useful gains	597.9251	638.0033	662.7084	632.8627	508.2836	332.2432	196.6345	188.8064	360.6240	507.5984	559.4681	567.0967	(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	1071.1906	1050.2313	946.2446	773.3565	552.6227	338.1714	197.3510	189.4879	376.0585	620.3302	863.7206	1059.8981	(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	352.1095	277.0172	210.9509	101.1556	32.9883	0.0000	0.0000	0.0000	0.0000	83.8724	219.0618	366.6443	(98)
Space heating												1643.8000	(98)
Space heating per m2											(98) / (4) =	23.4093	(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 %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1812.3484	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	352.1095	277.0172	210.9509	101.1556	32.9883	0.0000	0.0000	0.0000	0.0000	83.8724	219.0618	366.6443	(98)	
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)	
Space heating fuel (main heating system)	388.2133	305.4214	232.5809	111.5276	36.3708	0.0000	0.0000	0.0000	0.0000	92.4724	241.5235	404.2384	(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	146.4185	113.7097	91.6159	50.3493	31.8168	6.5788	6.7822	29.2912	51.4084	93.4127	124.8272	147.6872	(64)	
Efficiency of water heater	89.5811	89.5912	89.5469	89.4360	88.8449	87.0000	87.0000	87.0000	87.0000	88.7121	89.3211	89.6057	(216)	
(217)m	89.5811	89.5912	89.5469	89.4360	88.8449	87.0000	87.0000	87.0000	87.0000	88.7121	89.3211	89.6057	(217)	
Fuel for water heating, kWh/month	163.4480	126.9207	102.3106	56.2965	35.8116	7.5618	7.7957	33.6680	59.0901	105.2988	139.7510	164.8189	(219)	
Water heating fuel used												1002.7717	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1812.3484	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Centralised, Database: in-use factor = 1.4000, SFP = 0.4200)														
mechanical ventilation fans (SFP = 0.4200)													91.0312	(230a)
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													216.0312	(231)
Electricity for lighting (calculated in Appendix L)													319.7904	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.64 * 1120 * 1.00) =										-573.3580			-573.3580	(233)
Total delivered energy for all uses													2777.5837	(238)

10a. Fuel costs - using BEDF prices (491)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1812.3484	3.6300	65.7882 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1002.7717	3.6300	36.4006 (247)
Mechanical ventilation fans	91.0312	19.4400	17.6965 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Pump for solar water heating	50.0000	19.4400	9.7200 (249)
Energy for lighting	319.7904	19.4400	62.1673 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-573.3580	19.4400	-111.4608 (252)
Total energy cost			189.8918 (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	1812.3484	0.2160	391.4672 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1002.7717	0.2160	216.5987 (264)
Space and water heating			608.0659 (265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	216.0312	0.5190	112.1202 (267)
Energy for lighting	319.7904	0.5190	165.9712 (268)
Energy saving/generation technologies			
PV Unit	-573.3580	0.5190	-297.5728 (269)
Total kg/year			588.5846 (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	1812.3484	1.2200	2211.0650 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1002.7717	1.2200	1223.3815 (264)
Space and water heating			3434.4464 (265)
Pumps and fans	216.0312	3.0700	663.2159 (267)
Energy for lighting	319.7904	3.0700	981.7567 (268)
Energy saving/generation technologies			
PV Unit	-573.3580	3.0700	-1760.2090 (269)
Primary energy kWh/year			3319.2100 (272)
Primary energy kWh/m2/year			47.2687 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 82	Issued on Date	29/03/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Project	5 Haines Crescent, West End, Southampton, SO30 3LG		
Calculation Type	New Build (As Built)		

SAP Rating	86 B	DER	14.79	TER	19.09
Environmental	89 B	% DER<TER	22.53		
CO ₂ Emissions (t/year)	0.77	DFEE	44.56	TREE	52.74
General Requirements Compliance	Pass	% DFEE<TFEE	15.52		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.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 82	Issued on Date	29/03/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Project	5 Haines Crescent, West End, Southampton, SO30 3LG		
Calculation Type	New Build (As Built)		

SAP Rating	86 B	DER	14.79	TER	19.09
Environmental	89 B	% DER<TER	22.53		
CO ₂ Emissions (t/year)	0.77	DFEE	44.56	TFEE	52.74
General Requirements Compliance	Pass	% DFEE<TFEE	15.52		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.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 82	Issued on Date	29/03/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Project	5 Haines Crescent, West End, Southampton, SO30 3LG		
Calculation Type	New Build (As Built)		

SAP Rating	86 B	DER	14.79	TER	19.09
Environmental	89 B	% DER<TER	22.53		
CO ₂ Emissions (t/year)	0.77	DFEE	44.56	TFEE	52.74
General Requirements Compliance	Pass	% DFEE<TFEE	15.52		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.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 82	Issued on Date	29/03/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Property	5 Haines Crescent, West End, Southampton, SO30 3LG		
SAP Rating	86 B	DER	14.79
Environmental	89 B	TER	19.09
CO ₂ Emissions (t/year)	0.77	% DER<TER	22.53
General Requirements Compliance	Pass	DLEE	44.56
		TFEE	52.74
		% DLEE<TFEE	15.52
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com		Assessor ID
			E477-0001
Client	Foreman Homes, FORE		

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

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

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	16.79 m	35.11 m ²	2.39 m
1st Storey:	16.79 m	35.11 m ²	2.67 m

7.0 Living Area	15.62	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	167.11	kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Brick and Block	Cavity Wall	Other	0.24	42.22	84.96	70.60

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	42.92

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
GF Stud	Plasterboard on timber frame	9.00	60.00
First Floor	Plasterboard on timber frame	9.00	75.19

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	35.11	35.11

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	35.11

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	35.11

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.11

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
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 (m ²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	North East							2.12	
Front Elevation	Window	[1] Brick and Block	North East	None	0.00					3.43	
Side Elevation	Window	[1] Brick and Block	North West	None	0.00					1.32	
Rear Elevation	Window	[1] Brick and Block	South West	None	0.00					7.49	

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)	10.13	0.053	No	CD0025
Independently assessed	E3 Sill	7.61	0.034	No	CD0027
Independently assessed	E4 Jamb	27.30	0.039	No	CD0028
Independently assessed	E5 Ground floor (normal)	16.79	0.060	No	CBA-302
Independently assessed	E6 Intermediate floor within a dwelling	16.79	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	8.41	0.060	No	CD0033
Independently assessed	E12 Gable (insulation at ceiling level)	8.50	0.054	No	CD0031
Independently assessed	E16 Corner (normal)	10.10	0.050	No	CD0035
Table K1 - Approved	E18 Party wall between dwellings	10.10	0.060	No	
Table K1 - Default	P1 Party wall - Ground floor	8.50	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.50	0.000	No	
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	8.50	0.240	No	

Y-value 0.054 W/m²K

18.0 Pressure Testing

Designed AP ₅₀	5.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.15	m ³ /(h.m ²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

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	Yes
Approved Installation	No
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - centralised
MV Reference Number	500233
Configuration	2
Manufacturer SFP	0.30
Duct Type	Rigid
Wet Rooms	2

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				0
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	10	
Total number of L.E.L. fittings	10	
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

	Database	
Description	Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17503	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.0	
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	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	Gas/Oil, time clock
25.0 Main Heating 2	None

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
0.64	South West	45°	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	£26	B 88	