



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project: 4 Oram Way
WEST END, SO30 3JW

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
tobiaswhiting26@gmail.com

Report Issue Date: 15/02/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BUILDING REGULATION COMPLIANCE

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 4	Issued on Date	15/02/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Property	4 Oram Way, WEST END, SO30 3JW		
SAP Rating	86 B	DER	15.15
Environmental	89 B	TER	19.74
CO ₂ Emissions (t/year)	0.79	% DER<TER	23.25
General Requirements Compliance	Pass	DLEE	47.15
		TLEE	55.82
		% DLEE<TLEE	15.53
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 TLEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.74	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.15	kgCO ₂ /m ²	Pass
	-4.59 (-23.3%)	kgCO ₂ /m ²	

1b TLEE and DLEE

Target Fabric Energy Efficiency (TLEE)	55.82	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DLEE)	47.15	kWh/m ² /yr	
	-8.6 (-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	4.47 (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

7.49 m², No overhang

Windows facing East

1.32 m², No overhang

Windows facing South

3.43 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

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

Maximum

10.0 m³/(h.m²) @ 50 Pa

Pass

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)

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	0.62	kW

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.



THERMAL BRIDGING

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 4	Issued on Date	15/02/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Property	4 Oram Way, WEST END, SO30 3JW		

SAP Rating	86 B	DER	15.15	TER	19.74
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.79	DFEE	47.15	TFEE	55.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com	Assessor ID	E477-0001
------------------	--	-------------	-----------

Client	Foreman Homes, FORE
--------	---------------------

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.098	1.26	0.12	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.053	3.76	0.20	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.043	3.60	0.15	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.060	1.51	0.09	Birtley Supatherm
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)	Table K1 - Approved	0.160	16.79	2.69	
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	16.79	1.01	
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)	Independently assessed	0.049	8.50	0.42	CD0020

Total: **8.47** W/mK:
Y-Value: **0.055** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	SAP 0647 Plot 4			Issued on Date	15/02/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)		
Property	4 Oram Way, WEST END, SO30 3JW				
SAP Rating	86 B	DER	15.15	TER	19.74
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.79	DFEE	47.15	TFEE	55.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 01329 313079, tobiaswhiting26@gmail.com			Assessor ID	E477-0001
Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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) 19.74 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.15 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)47.2 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: 4.47 (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: 7.49 m², No overhang

Windows facing East: 1.32 m², No overhang

Windows facing South: 3.43 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 0.62 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	=	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												4.4700
Infiltration rate												0.2235 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2067 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2636	0.2584	0.2533	0.2274	0.2222	0.1964	0.1964	0.1912	0.2067	0.2222	0.2326	0.2429 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5136	0.5084	0.5033	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)							8.4729 (36)
Total fabric heat loss						(33) + (36) =	49.4884 (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	30.1101	29.8071	29.5041	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133 (38)
Heat transfer coeff	79.5985	79.2955	78.9924	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017 (39)
Average = Sum(39)m / 12 =												78.9251 (39)
HLP	1.1336	1.1292	1.1249	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222 (40)
HLP (average)												1.1240 (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)
Total per year (kWh/year) = Sum(64)m = 1746.1553 (64)												
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												

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	
North				7.4900	10.6334		0.6300	0.7000		0.7700	24.3403 (74)	
East				1.3200	19.6403		0.6300	0.7000		0.7700	7.9231 (76)	
South				3.4300	46.7521		0.6300	0.7000		0.7700	49.0080 (78)	
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542 (83)
Total gains	431.3643	490.3670	542.5061	595.5237	632.7274	621.8858	592.1636	552.9780	510.9363	459.8640	420.6231	409.0030 (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	40.9505	41.1070	41.2646	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645
util living area	3.7300	3.7405	3.7510	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576
	0.9898	0.9826	0.9671	0.9283	0.8436	0.7004	0.5503	0.6022	0.8136	0.9465	0.9829	0.9916 (86)
MIT	19.3578	19.5520	19.8679	20.2688	20.6366	20.8745	20.9619	20.9462	20.7664	20.2987	19.7555	19.3241 (87)
Th 2	19.9735	19.9770	19.9805	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827 (88)
util rest of house	0.9875	0.9786	0.9593	0.9100	0.8019	0.6206	0.4375	0.4897	0.7498	0.9291	0.9783	0.9897 (89)
MIT 2	18.4782	18.6732	18.9875	19.3779	19.7175	19.9130	19.9691	19.9617	19.8359	19.4131	18.8810	18.4516 (90)
Living area fraction	18.6739	18.8687	19.1834	19.5760	19.9220	20.1269	20.1899	20.1807	20.0429	19.6101	19.0755	0.2224 (91)
MIT	18.6739	18.8687	19.1834	19.5760	19.9220	20.1269	20.1899	20.1807	20.0429	19.6101	19.0755	18.6457 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6739	18.8687	19.1834	19.5760	19.9220	20.1269	20.1899	20.1807	20.0429	19.6101	19.0755	18.6457 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9835	0.9730	0.9514	0.9011	0.7991	0.6329	0.4617	0.5131	0.7541	0.9211	0.9728	0.9862 (94)
Ext temp.	424.2280	477.1193	516.1636	536.6503	505.5933	393.6004	273.4070	283.7263	385.3057	423.5951	409.1858	403.3630 (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	1144.1390	1107.6536	1001.8909	841.2903	647.9063	435.5276	282.8939	297.9252	468.3072	710.0129	943.6906	1138.3465 (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	535.6138	423.7190	361.3812	219.3408	105.8809	0.0000	0.0000	0.0000	0.0000	213.0948	384.8435	546.8278 (98)
Space heating per m2												2790.7018 (98)
												39.7423 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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	3076.8487 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	535.6138	423.7190	361.3812	219.3408	105.8809	0.0000	0.0000	0.0000	0.0000	213.0948	384.8435	546.8278 (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)	590.5334	467.1654	398.4357	241.8311	116.7375	0.0000	0.0000	0.0000	0.0000	234.9447	424.3037	602.8972 (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	89.7630	89.6868	89.5303	89.2049	88.5615	87.0000	87.0000	87.0000	87.0000	89.1461	89.5924	87.0000 (216)
Fuel for water heating, kWh/month	194.0986	170.8824	178.9831	159.9305	157.0602	141.6852	134.9651	149.6342	149.8566	166.0103	176.0422	188.9937 (219)
Water heating fuel used												1968.1421 (219)
Annual totals kWh/year												
Space heating fuel - main system												3076.8487 (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 * 0.62 * 1080 * 1.00) =												-535.4442 (233)
Total delivered energy for all uses												4995.3683 (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	3076.8487	0.2160	664.5993 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1968.1421	0.2160	425.1187 (264)
Space and water heating			1089.7180 (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	-535.4442	0.5190	-277.8955 (269)
Total CO2, kg/year			1063.9639 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.1500 (273)

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

DER		15.1500 ZC1
Total Floor Area	TFA	70.2200
Assumed number of occupants	N	2.2515
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.6930 ZC2
CO2 emissions from cooking, equation (L16)		2.4642 ZC3
Total CO2 emissions		34.3072 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		34.3072 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 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							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							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3875 (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	0.4940	0.4843	0.4746	0.4262	0.4165	0.3681	0.3681	0.3584	0.3875	0.4165	0.4359	0.4553 (22b)
Effective ac	0.6220	0.6173	0.6126	0.5908	0.5867	0.5677	0.5677	0.5642	0.5751	0.5867	0.5950	0.6036 (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)							9.1608 (36)					
Total fabric heat loss						(33) + (36) =	49.3447 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.4668	Feb 36.1890	Mar 35.9168	Apr 34.6379	May 34.3986	Jun 33.2847	Jul 33.2847	Aug 33.0785	Sep 33.7138	Oct 34.3986	Nov 34.8827	Dec 35.3887 (38)
Heat transfer coeff	85.8115	85.5337	85.2614	83.9826	83.7433	82.6294	82.6294	82.4231	83.0585	83.7433	84.2273	84.7334 (39)
Average = Sum(39)m / 12 =												83.9814 (39)
HLP	Jan 1.2220	Feb 1.2181	Mar 1.2142	Apr 1.1960	May 1.1926	Jun 1.1767	Jul 1.1767	Aug 1.1738	Sep 1.1828	Oct 1.1926	Nov 1.1995	Dec 1.2067 (40)
HLP (average)												1.1960 (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)
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												

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			
North				7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)			
East				1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)			
South				3.4300	46.7521	0.6300	0.7000	0.7700	49.0080 (78)			

Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542 (83)
Total gains	437.3899	495.7980	547.3451	599.7721	636.3822	624.9485	595.2313	556.6375	515.1917	464.7100	426.0581	415.0314 (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	56.8268	57.0113	57.1934	58.0643	58.2302	59.0152	59.0152	59.1629	58.7103	58.2302	57.8956	57.5498	
alpha	4.7885	4.8008	4.8129	4.8710	4.8820	4.9343	4.9343	4.9442	4.9140	4.8820	4.8597	4.8367	
util living area	0.9976	0.9952	0.9889	0.9671	0.9019	0.7554	0.5887	0.6449	0.8719	0.9777	0.9953	0.9982	(86)
MIT	19.6842	19.8326	20.0812	20.4215	20.7281	20.9245	20.9825	20.9731	20.8353	20.4471	20.0102	19.6640	(87)
Th 2	19.9024	19.9056	19.9087	19.9232	19.9259	19.9387	19.9387	19.9410	19.9338	19.9259	19.9204	19.9147	(88)
util rest of house	0.9968	0.9936	0.9847	0.9539	0.8611	0.6633	0.4578	0.5139	0.8045	0.9663	0.9934	0.9975	(89)
MIT 2	18.1567	18.3753	18.7387	19.2362	19.6521	19.8867	19.9321	19.9297	19.7973	19.2807	18.6457	18.1357	(90)
Living area fraction	18.4965	18.6995	19.0373	19.4999	19.8915	20.1176	20.1658	20.1618	20.0282	19.5402	18.9492	18.4756	(91)
MIT	18.4965	18.6995	19.0373	19.4999	19.8915	20.1176	20.1658	20.1618	20.0282	19.5402	18.9492	18.4756	(92)
Temperature adjustment	18.4965	18.6995	19.0373	19.4999	19.8915	20.1176	20.1658	20.1618	20.0282	19.5402	18.9492	18.4756	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	435.3069	491.2991	536.4677	568.0651	547.0078	425.1696	289.9342	302.2056	418.1088	446.4236	422.1302	413.4845	(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	1218.2214	1180.3219	1068.9484	890.2045	685.9796	455.9149	294.6373	310.0575	492.3841	748.6795	998.0297	1209.6214	(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	582.4884	463.0234	396.1656	231.9404	103.3950	0.0000	0.0000	0.0000	0.0000	224.8784	414.6477	592.3258	(98)
Space heating												3008.8646	(98)
Space heating per m2												42.8491	(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												3221.4824 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	582.4884	463.0234	396.1656	231.9404	103.3950	0.0000	0.0000	0.0000	0.0000	224.8784	414.6477	592.3258 (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)	623.6492	495.7424	424.1602	248.3302	110.7013	0.0000	0.0000	0.0000	0.0000	240.7692	443.9482	634.1818 (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	87.6648	87.4727	87.0500	86.0653	84.1361	80.3000	80.3000	80.3000	80.3000	85.8707	87.1674	80.3000 (216)
Fuel for water heating, kWh/month	219.1997	191.8972	200.6259	179.9810	178.2491	164.4916	157.5955	175.6820	177.6222	189.1373	198.8967	213.8568 (219)
Water heating fuel used												2247.2350 (219)
Annual totals kWh/year												
Space heating fuel - main system												3221.4824 (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												5863.5079 (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	3221.4824	0.2160	695.8402 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2247.2350	0.2160	485.4028 (264)
Space and water heating			1181.2430 (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			1386.1392 (272)
Emissions per m2 for space and water heating			16.8220 (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) = (16.8220 * 1.00) + 2.3636 + 0.5543, rounded to 2 d.p.			19.7400 (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	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					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					4.4700
Infiltration rate					0.3924 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3629 (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	0.4627	0.4537	0.4446	0.3992	0.3902	0.3448	0.3448	0.3357	0.3629	0.3902	0.4083	0.4265 (22b)
Effective ac	0.6071	0.6029	0.5988	0.5797	0.5761	0.5594	0.5594	0.5564	0.5659	0.5761	0.5834	0.5909 (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)
8.4729 (36)
(33) + (36) = 49.4884 (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	35.5903	35.3466	35.1076	33.9855	33.7755	32.7981	32.7981	32.6171	33.1746	33.7755	34.2003	34.6443 (38)
Heat transfer coeff	85.0787	84.8349	84.5960	83.4738	83.2639	82.2865	82.2865	82.1055	82.6630	83.2639	83.6886	84.1327 (39)
Average = Sum(39)m / 12 =												83.4728 (39)
HLP	1.2116	1.2081	1.2047	1.1887	1.1858	1.1718	1.1718	1.1693	1.1772	1.1858	1.1918	1.1981 (40)
HLP (average)												1.1887 (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

North	7.4900	10.6334	0.6300	0.7000	0.7700	24.3403 (74)
East	1.3200	19.6403	0.6300	0.7000	0.7700	7.9231 (76)
South	3.4300	46.7521	0.6300	0.7000	0.7700	49.0080 (78)

Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542	(83)
Total gains	394.8091	454.5487	508.2140	563.3049	601.8552	592.9083	564.7943	523.5459	480.7696	427.5517	385.8878	373.1785	(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	37.2810	37.3881	37.4937	37.9978	38.0936	38.5461	38.5461	38.6310	38.3705	38.0936	37.9003	37.7002	
alpha	3.4854	3.4925	3.4996	3.5332	3.5396	3.5697	3.5697	3.5754	3.5580	3.5396	3.5267	3.5133	
util living area	0.9917	0.9856	0.9727	0.9395	0.8660	0.7327	0.5869	0.6408	0.8420	0.9566	0.9863	0.9931	(86)
MIT	19.1267	19.3281	19.6649	20.1200	20.5363	20.8305	20.9438	20.9224	20.6960	20.1630	19.5685	19.0958	(87)
Th 2	19.9107	19.9135	19.9162	19.9290	19.9314	19.9426	19.9426	19.9447	19.9383	19.9314	19.9266	19.9215	(88)
util rest of house	0.9897	0.9822	0.9659	0.9233	0.8274	0.6530	0.4671	0.5234	0.7821	0.9418	0.9825	0.9916	(89)
MIT 2	18.2047	18.4067	18.7420	19.1959	19.5881	19.8462	19.9219	19.9134	19.7426	19.2458	18.6567	18.1819	(90)
Living area fraction									fLA = Living area / (4) =			0.2224	(91)
MIT	18.4098	18.6117	18.9473	19.4015	19.7990	20.0652	20.1492	20.1378	19.9547	19.4499	18.8595	18.3852	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.4098	18.6117	18.9473	19.4015	19.7990	20.0652	20.1492	20.1378	19.9547	19.4499	18.8595	18.3852	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9860	0.9768	0.9580	0.9134	0.8218	0.6633	0.4922	0.5468	0.7832	0.9332	0.9773	0.9884	(94)
Ext temp.	389.2774	443.9919	486.8668	514.5346	494.5864	393.2631	277.9711	286.2967	376.5322	399.0038	377.1244	368.8381	(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	1200.4439	1163.2309	1052.9937	876.5975	674.3573	449.7097	292.0550	306.8978	483.9662	736.8739	984.1394	1193.4362	(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 per m2	603.5079	483.3286	421.1984	260.6853	133.7495	0.0000	0.0000	0.0000	0.0000	251.3753	437.0508	613.5010	(98)
												3204.3969	(98)
												45.6337	(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	773.4931	608.9201	624.0018	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7829	0.8512	0.8217	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	605.5336	518.3243	512.7564	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	776.8471	742.3107	695.5147	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	123.3457	166.6459	135.9721	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												425.9638 (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	30.8364	41.6615	33.9930	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												106.4909 (107)
Space cooling per m2												1.5165 (108)
Energy for space heating												45.6337 (99)
Energy for space cooling												1.5165 (108)
Total												47.1502 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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												1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)		
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.3875 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	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)		
Adj infilt rate	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)		
	0.4940	0.4843	0.4746	0.4262	0.4165	0.3681	0.3681	0.3584	0.3875	0.4165	0.4359	0.4553 (22b)		
Effective ac	0.6220	0.6173	0.6126	0.5908	0.5867	0.5677	0.5677	0.5642	0.5751	0.5867	0.5950	0.6036 (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)							9.1608 (36)					
Total fabric heat loss						(33) + (36) =	49.3447 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.4668	Feb 36.1890	Mar 35.9168	Apr 34.6379	May 34.3986	Jun 33.2847	Jul 33.2847	Aug 33.0785	Sep 33.7138	Oct 34.3986	Nov 34.8827	Dec 35.3887 (38)
Heat transfer coeff	85.8115	85.5337	85.2614	83.9826	83.7433	82.6294	82.6294	82.4231	83.0585	83.7433	84.2273	84.7334 (39)
Average = Sum(39)m / 12 =												83.9814 (39)
HLP	Jan 1.2220	Feb 1.2181	Mar 1.2142	Apr 1.1960	May 1.1926	Jun 1.1767	Jul 1.1767	Aug 1.1738	Sep 1.1828	Oct 1.1926	Nov 1.1995	Dec 1.2067 (40)
HLP (average)												1.1960 (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	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													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
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)	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)
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	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)
	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	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North				7.4900	10.6334		0.6300		0.7000		0.7700		24.3403 (74)
East				1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South				3.4300	46.7521		0.6300		0.7000		0.7700		49.0080 (78)

Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972	69.1542	(83)
Total gains	394.8091	454.5487	508.2140	563.3049	601.8552	592.9083	564.7943	523.5459	480.7696	427.5517	385.8878	373.1785	(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	56.8268	57.0113	57.1934	58.0643	58.2302	59.0152	59.0152	59.1629	58.7103	58.2302	57.8956	57.5498	
util living area	4.7885	4.8008	4.8129	4.8710	4.8820	4.9343	4.9343	4.9442	4.9140	4.8820	4.8597	4.8367	
	0.9985	0.9967	0.9918	0.9740	0.9173	0.7807	0.6156	0.6767	0.8948	0.9840	0.9969	0.9989	(86)
MIT	19.6286	19.7793	20.0320	20.3799	20.6991	20.9122	20.9788	20.9669	20.8100	20.4025	19.9581	19.6090	(87)
Th 2	19.9024	19.9056	19.9087	19.9232	19.9259	19.9387	19.9387	19.9410	19.9338	19.9259	19.9204	19.9147	(88)
util rest of house	0.9980	0.9956	0.9887	0.9632	0.8808	0.6905	0.4811	0.5433	0.8341	0.9754	0.9957	0.9985	(89)
MIT 2	18.6551	18.8078	19.0615	19.4150	19.7152	19.8964	19.9331	19.9312	19.8227	19.4429	18.9984	18.6452	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.8716	19.0239	19.2774	19.6296	19.9341	20.1224	20.1657	20.1615	20.0423	19.6564	19.2119	18.8596	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.8716	19.0239	19.2774	19.6296	19.9341	20.1224	20.1657	20.1615	20.0423	19.6564	19.2119	18.8596	(93)

8. Space heating requirement													

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9973	0.9943	0.9862	0.9594	0.8811	0.7079	0.5114	0.5732	0.8416	0.9725	0.9945	0.9979	(94)
Ext temp.	393.7258	451.9419	501.2221	540.4355	530.3102	419.6930	288.8296	300.1166	404.6304	415.7839	383.7511	372.4002	(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	1250.4127	1208.0709	1089.4202	901.1003	689.5497	456.3108	294.6341	310.0388	493.5621	758.4094	1020.1492	1242.1577	(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 per m2	637.3750	508.1187	437.6194	259.6787	118.4742	0.0000	0.0000	0.0000	0.0000	254.9134	458.2067	647.0996	(98)
	(98) / (4) =												47.3011 (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	776.7165	611.4577	626.4159	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8316	0.9010	0.8721	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	645.8858	550.8979	546.3128	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	776.8471	742.3107	695.5147	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	94.2921	142.4111	111.0062	0.0000	0.0000	0.0000	0.0000	(104)
													347.7095 (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	23.5730	35.6028	27.7515	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												86.9274 (107)
Space cooling per m2												1.2379 (108)
Energy for space heating												47.3011 (99)
Energy for space cooling												1.2379 (108)
Total												48.5391 (109)
Target Fabric Energy Efficiency (TFEE)												55.8 (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	=	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) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate													4.4700
Number of sides sheltered													0.2235 (18)
													1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2067 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	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)	
Adj infilt rate	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)	
	0.2429	0.2274	0.2274	0.2067	0.2119	0.2016	0.2016	0.1964	0.1964	0.2119	0.2067	0.2119 (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)							8.4729 (36)
Total fabric heat loss						(33) + (36) =	49.4884 (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	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)
Heat transfer coeff	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017 (39)
Average = Sum(39)m / 12 =												78.8017 (39)
HLP	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222 (40)
HLP (average)												1.1222 (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												
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		
North				7.4900	13.4684	0.6300	0.7000	0.7700		30.8298 (74)		
East				1.3200	25.1733	0.6300	0.7000	0.7700		10.1551 (76)		
South				3.4300	56.5862	0.6300	0.7000	0.7700		59.3166 (78)		
Solar gains	100.3015	150.0403	223.7650	306.5532	349.2470	396.8048	362.2780	325.3717	263.2108	182.9298	120.6667	80.7253 (83)
Total gains	614.0025	659.7123	713.9940	766.6754	778.6527	798.5940	747.8512	718.6435	673.7386	623.7647	595.1926	580.6383 (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	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645
alpha	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576
util living area	0.9603	0.9473	0.9119	0.8322	0.6940	0.4836	0.3434	0.3464	0.6018	0.8334	0.9330	0.9656 (86)
MIT	19.8613	19.9833	20.2611	20.5968	20.8500	20.9713	20.9941	20.9941	20.9346	20.6688	20.2301	19.8229 (87)
Th 2	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827 (88)
util rest of house	0.9516	0.9360	0.8928	0.7960	0.6304	0.3949	0.2397	0.2385	0.5108	0.7882	0.9160	0.9579 (89)
MIT 2	18.9806	19.0988	19.3653	19.6751	19.8887	19.9711	19.9816	19.9816	19.9518	19.7463	19.3407	18.9438 (90)
Living area fraction									fLA = Living area / (4) =			0.2224 (91)
MIT	19.1765	19.2955	19.5645	19.8802	20.1026	20.1936	20.2068	20.2068	20.1704	19.9515	19.5386	19.1393 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1765	19.2955	19.5645	19.8802	20.1026	20.1936	20.2068	20.2068	20.1704	19.9515	19.5386	19.1393 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9431	0.9268	0.8836	0.7919	0.6384	0.4138	0.2628	0.2626	0.5286	0.7866	0.9071	0.9499 (94)
Ext temp.	579.0406	611.4010	630.8844	607.1077	497.1071	330.4717	196.5607	188.7267	356.1326	490.6459	539.8875	551.5547 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	1069.8504	1047.7112	942.8254	770.6931	551.8134	338.3402	197.5395	189.6638	375.9159	618.7126	861.9788	1059.0408 (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	365.1625	293.2004	232.0841	117.7814	40.7014	0.0000	0.0000	0.0000	0.0000	95.2816	231.9058	377.5697 (98)
RHI space heating demand												1753.6870 (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					4.4700
Infiltration rate					0.2235 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2067 (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	0.2636	0.2584	0.2533	0.2274	0.2222	0.1964	0.1964	0.1912	0.2067	0.2222	0.2326	0.2429 (22b)
Mechanical extract ventilation - centralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5136	0.5084	0.5033	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)							8.4729 (36)
Total fabric heat loss						(33) + (36) =	49.4884 (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	30.1101	29.8071	29.5041	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133 (38)
Average = Sum(39)m / 12 =	79.5985	79.2955	78.9924	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017 (39)
												78.9251 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1336	1.1292	1.1249	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222 (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 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												2462.0970	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	443.0688	345.5602	286.9647	166.1606	74.5412	0.0000	0.0000	0.0000	0.0000	155.3726	306.6948	454.7592	(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)	488.4992	380.9925	316.3889	183.1980	82.1843	0.0000	0.0000	0.0000	0.0000	171.3039	338.1420	501.3883	(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	89.6242	89.5301	89.3386	88.9524	88.2562	87.0000	87.0000	87.0000	87.0000	88.8565	89.4087	89.6637	(216)
(217)m	89.6242	89.5301	89.3386	88.9524	88.2562	87.0000	87.0000	87.0000	87.0000	88.8565	89.4087	89.6637	(217)
Fuel for water heating, kWh/month	194.3992	171.1815	179.3672	160.3845	157.6034	141.6852	134.9651	149.6342	149.8566	166.5515	176.4039	189.2715	(219)
Water heating fuel used												1971.3039	(219)
Annual totals kWh/year													
Space heating fuel - main system												2462.0970	(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 * 0.62 * 1080 * 1.00) =										-535.4442		-535.4442	(233)
Total delivered energy for all uses												4383.7784	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2462.0970	3.4800	85.6810 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1971.3039	3.4800	68.6014 (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	-535.4442	13.1900	-70.6251 (252)
Total energy cost			267.7371 (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] =	0.9760 (257)
SAP value		86.3854
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	2462.0970	0.2160	531.8130 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1971.3039	0.2160	425.8016 (264)
Space and water heating			957.6146 (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	-535.4442	0.5190	-277.8955 (269)
Total kg/year			931.8605 (272)
CO2 emissions per m2			13.2700 (273)
EI value			89.1625
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	$3.48 / 0.8847 = 3.934$, stars = 4
Water heating environmental impact	$0.216 / 0.8847 = 0.2442$, 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	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					4.4700
Infiltration rate					0.2235 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2067 (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	0.2429	0.2274	0.2274	0.2067	0.2119	0.2016	0.2016	0.1964	0.1964	0.2119	0.2067	0.2119 (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)							8.4729 (36)
Total fabric heat loss						(33) + (36) =	49.4884 (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	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017 (39)
Average = Sum(39)m / 12 =												78.8017 (39)
HLP	Jan 1.1222	Feb 1.1222	Mar 1.1222	Apr 1.1222	May 1.1222	Jun 1.1222	Jul 1.1222	Aug 1.1222	Sep 1.1222	Oct 1.1222	Nov 1.1222	Dec 1.1222 (40)
HLP (average)												1.1222 (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 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)
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)

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
	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
North	7.4900			13.4684		0.6300		0.7000		0.7700		30.8298 (74)
East	1.3200			25.1733		0.6300		0.7000		0.7700		10.1551 (76)
South	3.4300			56.5862		0.6300		0.7000		0.7700		59.3166 (78)
Solar gains	100.3015	150.0403	223.7650	306.5532	349.2470	396.8048	362.2780	325.3717	263.2108	182.9298	120.6667	80.7253 (83)
Total gains	614.0025	659.7123	713.9940	766.6754	778.6527	798.5940	747.8512	718.6435	673.7386	623.7647	595.1926	580.6383 (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	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645
util living area	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576
	0.9603	0.9473	0.9119	0.8322	0.6940	0.4836	0.3434	0.3464	0.6018	0.8334	0.9330	0.9656 (86)
MIT	19.8613	19.9833	20.2611	20.5968	20.8500	20.9713	20.9941	20.9941	20.9346	20.6688	20.2301	19.8229 (87)
Th 2	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827 (88)
util rest of house	0.9516	0.9360	0.8928	0.7960	0.6304	0.3949	0.2397	0.2385	0.5108	0.7882	0.9160	0.9579 (89)
MIT 2	18.9806	19.0988	19.3653	19.6751	19.8887	19.9711	19.9816	19.9816	19.9518	19.7463	19.3407	18.9438 (90)
Living area fraction									fLA = Living area / (4) =			0.2224 (91)
MIT	19.1765	19.2955	19.5645	19.8802	20.1026	20.1936	20.2068	20.2068	20.1704	19.9515	19.5386	19.1393 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1765	19.2955	19.5645	19.8802	20.1026	20.1936	20.2068	20.2068	20.1704	19.9515	19.5386	19.1393 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9431	0.9268	0.8836	0.7919	0.6384	0.4138	0.2628	0.2626	0.5286	0.7866	0.9071	0.9499 (94)
Ext temp.	579.0406	611.4010	630.8844	607.1077	497.1071	330.4717	196.5607	188.7267	356.1326	490.6459	539.8875	551.5547 (95)
Heat loss rate W	5.6000	6.0000	7.6000	10.1000	13.1000	15.9000	17.7000	17.8000	15.4000	12.1000	8.6000	5.7000 (96)
Month fracti	1069.8504	1047.7112	942.8254	770.6931	551.8134	338.3402	197.5395	189.6638	375.9159	618.7126	861.9788	1059.0408 (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	365.1625	293.2004	232.0841	117.7814	40.7014	0.0000	0.0000	0.0000	0.0000	95.2816	231.9058	377.5697 (98)
Space heating per m2												1753.6870 (98)
										(98) / (4) =		24.9742 (99)

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													1933.5028 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	365.1625	293.2004	232.0841	117.7814	40.7014	0.0000	0.0000	0.0000	0.0000	95.2816	231.9058	377.5697	(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)	402.6047	323.2640	255.8810	129.8583	44.8748	0.0000	0.0000	0.0000	0.0000	105.0514	255.6844	416.2841	(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	89.4709	89.3949	89.1514	88.6351	87.8109	87.0000	87.0000	87.0000	87.0000	88.4126	89.1650	89.5194	(217)
Fuel for water heating, kWh/month	194.7323	171.4404	179.7438	160.9585	158.4026	141.6852	134.9651	149.6342	149.8566	167.3876	176.8860	189.5765	(219)
Water heating fuel used												1975.2690	(219)
Annual totals kWh/year													
Space heating fuel - main system												1933.5028	(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 * 0.62 * 1206 * 1.00) =										-598.1811		-598.1811	(233)
Total delivered energy for all uses												3796.4125	(238)

10a. Fuel costs - using BEDF prices (490)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1933.5028	3.6300	70.1862 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1975.2690	3.6300	71.7023 (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	-598.1811	19.4400	-116.2864 (252)
Total energy cost			215.0458 (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	1933.5028	0.2160	417.6366 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1975.2690	0.2160	426.6581 (264)
Space and water heating			844.2947 (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	-598.1811	0.5190	-310.4560 (269)
Total kg/year			785.9802 (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	1933.5028	1.2200	2358.8734 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1975.2690	1.2200	2409.8282 (264)
Space and water heating			4768.7017 (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	-598.1811	3.0700	-1836.4159 (269)
Primary energy kWh/year			4423.7583 (272)
Primary energy kWh/m ² /year			62.9986 (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 (23.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£26 2.62 kg/m ²	B 88	B 91
Total Savings	£26 2.62 kg/m ²		

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

Fuel prices for cost data on this page from database revision number 490 TEST (31 Jan 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	£237	£202	£35
Space heating	£197	£197	£0
Water heating	£72	£46	£26
Lighting	£62	£62	£0
Generated (PV)	-£116	-£116	£0
Total cost of fuels	£215	£190	£25
Total cost of uses	£215	£189	£26
Delivered energy	54 kWh/m ²	41 kWh/m ²	13 kWh/m ²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m ²	11 kg/m ²	9 kg/m ²	3 kg/m ²
Primary energy	63 kWh/m ²	48 kWh/m ²	15 kWh/m ²

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	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					4.4700
Infiltration rate					0.2235 (18)
Number of sides sheltered					1 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.9250 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2067 (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	0.2636	0.2584	0.2533	0.2274	0.2222	0.1964	0.1964	0.1912	0.2067	0.2222	0.2326	0.2429 (22b)
Mechanical extract ventilation - centralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5136	0.5084	0.5033	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)						8.4729	(36)
Total fabric heat loss			(33) + (36) =			49.4884	(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	30.1101	29.8071	29.5041	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133	29.3133 (38)
Heat transfer coeff	79.5985	79.2955	78.9924	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017 (39)
Average = Sum(39)m / 12 =												78.9251 (39)
HLP	1.1336	1.1292	1.1249	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222	1.1222 (40)
HLP (average)												1.1240 (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
North				7.4900	10.6334		0.6300		0.7000		0.7700		24.3403 (74)
East				1.3200	19.6403		0.6300		0.7000		0.7700		7.9231 (76)
South				3.4300	46.7521		0.6300		0.7000		0.7700		49.0080 (78)
Solar gains	81.2713	142.2771	206.8063	279.7406	337.0639	345.6748	328.6246	283.7664	231.5216	160.3323	97.9972		69.1542 (83)
Total gains	594.9723	651.9491	697.0353	739.8628	766.4697	747.4640	714.1978	677.0382	642.0494	601.1672	572.5231		569.0671 (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	40.9505	41.1070	41.2646	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	
alpha	3.7300	3.7405	3.7510	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	
util living area	0.9718	0.9587	0.9329	0.8768	0.7717	0.6156	0.4684	0.5103	0.7198	0.8921	0.9563	0.9757	(86)
MIT	19.6331	19.8128	20.0970	20.4437	20.7421	20.9193	20.9777	20.9690	20.8511	20.4831	20.0002	19.5972	(87)
Th 2	19.9735	19.9770	19.9805	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	(88)
util rest of house	0.9659	0.9501	0.9187	0.8498	0.7222	0.5362	0.3674	0.4078	0.6471	0.8629	0.9458	0.9705	(89)
MIT 2	18.7489	18.9274	19.2063	19.5364	19.8018	19.9400	19.9752	19.9713	19.8949	19.5800	19.1182	18.7209	(90)
Living area fraction									fLA = Living area / (4) =			0.2224	(91)
MIT	18.9456	19.1244	19.4044	19.7382	20.0110	20.1579	20.1982	20.1933	20.1076	19.7809	19.3144	18.9158	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9456	19.1244	19.4044	19.7382	20.0110	20.1579	20.1982	20.1933	20.1076	19.7809	19.3144	18.9158	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9584	0.9413	0.9091	0.8424	0.7237	0.5506	0.3895	0.4298	0.6568	0.8561	0.9372	0.9637	(94)
Useful gains	570.2446	613.7016	633.6459	623.2901	554.7303	411.5603	278.1623	291.0207	421.7076	514.6386	536.5495	548.3965	(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	1165.7671	1127.9281	1019.3512	854.0687	654.9200	437.9688	283.5420	298.9155	473.4108	723.4727	962.5145	1159.6319	(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	443.0688	345.5602	286.9647	166.1606	74.5412	0.0000	0.0000	0.0000	0.0000	155.3726	306.6948	454.7592	(98)
Space heating													
Space heating per m2													(98) / (4) = 31.8018 (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													2462.0970 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	443.0688	345.5602	286.9647	166.1606	74.5412	0.0000	0.0000	0.0000	0.0000	155.3726	306.6948	454.7592	(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)	488.4992	380.9925	316.3889	183.1980	82.1843	0.0000	0.0000	0.0000	0.0000	171.3039	338.1420	501.3883	(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	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)
Efficiency of water heater	89.7330	89.7566	89.7699	89.7926	89.6907	87.0000	87.0000	87.0000	87.0000	89.2404	89.5696	89.7545	(216)
Fuel for water heating, kWh/month	167.5729	126.3893	102.9659	57.6714	29.9014	14.8057	9.7624	40.2439	64.1820	108.7981	144.4892	166.8337	(219)
Water heating fuel used												1033.6160	(219)
Annual totals kWh/year													
Space heating fuel - main system												2462.0970	(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 * 0.62 * 1080 * 1.00) =										-535.4442		-535.4442	(233)
Total delivered energy for all uses												3496.0905	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2462.0970	3.4800	85.6810 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1033.6160	3.4800	35.9698 (247)
Mechanical ventilation fans	91.0312	13.1900	12.0070 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	319.7904	13.1900	42.1804 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-535.4442	13.1900	-70.6251 (252)
Total energy cost			241.7006 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8810 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	87.7094
SAP rating (Section 12)		88 (258)
SAP band		B

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	2462.0970	0.2160	531.8130 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1033.6160	0.2160	223.2611 (264)
Space and water heating			755.0740 (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	-535.4442	0.5190	-277.8955 (269)
Total kg/year			755.2699 (272)
CO2 emissions per m2			10.7600 (273)
EI value			91.2163
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												4.4700
Infiltration rate												0.2235 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2067 (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												
	0.2429	0.2274	0.2274	0.2067	0.2119	0.2016	0.2016	0.1964	0.1964	0.2119	0.2067	0.2119 (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)							8.4729 (36)
Total fabric heat loss						(33) + (36) =	49.4884 (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	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017	78.8017 (39)
Average = Sum(39)m / 12 =												78.8017 (39)
HLP	Jan 1.1222	Feb 1.1222	Mar 1.1222	Apr 1.1222	May 1.1222	Jun 1.1222	Jul 1.1222	Aug 1.1222	Sep 1.1222	Oct 1.1222	Nov 1.1222	Dec 1.1222 (40)
HLP (average)												1.1222 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

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
North	7.4900	13.4684	0.6300	0.7000	0.7700	30.8298 (74)
East	1.3200	25.1733	0.6300	0.7000	0.7700	10.1551 (76)
South	3.4300	56.5862	0.6300	0.7000	0.7700	59.3166 (78)

Solar gains	100.3015	150.0403	223.7650	306.5532	349.2470	396.8048	362.2780	325.3717	263.2108	182.9298	120.6667	80.7253 (83)
Total gains	614.0025	659.7123	713.9940	766.6754	778.6527	798.5940	747.8512	718.6435	673.7386	623.7647	595.1926	580.6383 (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	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645	41.3645
alpha	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576	3.7576
util living area	0.9603	0.9473	0.9119	0.8322	0.6940	0.4836	0.3434	0.3464	0.6018	0.8334	0.9330	0.9656 (86)
MIT	19.8613	19.9833	20.2611	20.5968	20.8500	20.9713	20.9941	20.9941	20.9346	20.6688	20.2301	19.8229 (87)
Th 2	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827	19.9827 (88)
util rest of house	0.9516	0.9360	0.8928	0.7960	0.6304	0.3949	0.2397	0.2385	0.5108	0.7882	0.9160	0.9579 (89)
MIT 2	18.9806	19.0988	19.3653	19.6751	19.8887	19.9711	19.9816	19.9816	19.9518	19.7463	19.3407	18.9438 (90)
Living area fraction									fLA = Living area / (4) =			0.2224 (91)
MIT	19.1765	19.2955	19.5645	19.8802	20.1026	20.1936	20.2068	20.2068	20.1704	19.9515	19.5386	19.1393 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1765	19.2955	19.5645	19.8802	20.1026	20.1936	20.2068	20.2068	20.1704	19.9515	19.5386	19.1393 (93)

8. Space heating requirement

8c. Space cooling requirement

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

10a. Fuel costs - using BEDF prices (490)

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

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 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	-598.1811	0.5190	-310.4560 (269)
Total kg/year			601.7388 (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	1933.5028	1.2200	2358.8734 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1002.1607	1.2200	1222.6361 (264)
Space and water heating			3581.5095 (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	-598.1811	3.0700	-1836.4159 (269)
Primary energy kWh/year			3390.0662 (272)
Primary energy kWh/m2/year			48.2778 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0647 Plot 4	Issued on Date	15/02/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Project	4 Oram Way, WEST END, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	86 B	DER	15.15	TER	19.74
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.79	DFEE	47.15	TTEE	55.82
General Requirements Compliance	Pass	% DFEE<TTEE	15.53		

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 4	Issued on Date	15/02/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Project	4 Oram Way, WEST END, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	86 B	DER	15.15	TER	19.74
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.79	DFEE	47.15	TFEE	55.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		

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

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 4	Issued on Date	15/02/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Project	4 Oram Way, WEST END, SO30 3JW		
Calculation Type	New Build (As Built)		

SAP Rating	86 B	DER	15.15	TER	19.74
Environmental	89 B	% DER<TER	23.25		
CO ₂ Emissions (t/year)	0.79	DFEE	47.15	TFEE	55.82
General Requirements Compliance	Pass	% DFEE<TFEE	15.53		

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

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 4	Issued on Date	15/02/2022
Assessment Reference	As Built	Prop Type Ref	D (HA/AR)
Property	4 Oram Way, WEST END, SO30 3JW		
SAP Rating	86 B	DER	15.15
Environmental	89 B	TER	19.74
CO ₂ Emissions (t/year)	0.79	% DER<TER	23.25
General Requirements Compliance	Pass	DFEE	47.15
		TFEE	55.82
		% DFEE<TFEE	15.53
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	South
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	1
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
-----------------	-------	----------------

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	South							2.12	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					3.43	
Side Elevation	Window	[1] Brick and Block	East	None	0.00					1.32	
Rear Elevation	Window	[1] Brick and Block	North	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)	1.26	0.098	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.76	0.053	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.60	0.043	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.51	0.060	No	Birtley Supatherm
Independently assessed	E3 Sill	7.61	0.034	No	CD0027
Independently assessed	E4 Jamb	27.30	0.039	No	CD0028
Table K1 - Approved	E5 Ground floor (normal)	16.79	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	16.79	0.000	No	CD0029
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	16.79	0.060	No	
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	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.50	0.049	No	CD0020

Y-value 0.055 W/m²K

18.0 Pressure Testing

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

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present	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	14	
Total number of L.E.L. fittings	14	
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

Description	Database	
Percentage of Heat	Gas Combi	%
Database Ref. No.	100	
Fuel Type	17503	
Main Heating	Mains gas	
SAP Code	BGW	
In Winter	104	
In Summer	90.7	
Controls	87.0	
PCDF Controls	CBE Programmer, room thermostat and TRVs	
Delayed Start Stat	0	
Sap Code	No	
Flue Type	2106	
	Balanced	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
Combi boiler type	Standard Combi
Combi keep hot type	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
--------------------------------	------

32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.62	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£26	B 88	