



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project:

Contact: Tobias Whiting
Abacus Energy (UK) Ltd
toby@abacusenergyuk.com

Report Issue Date: 29/11/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

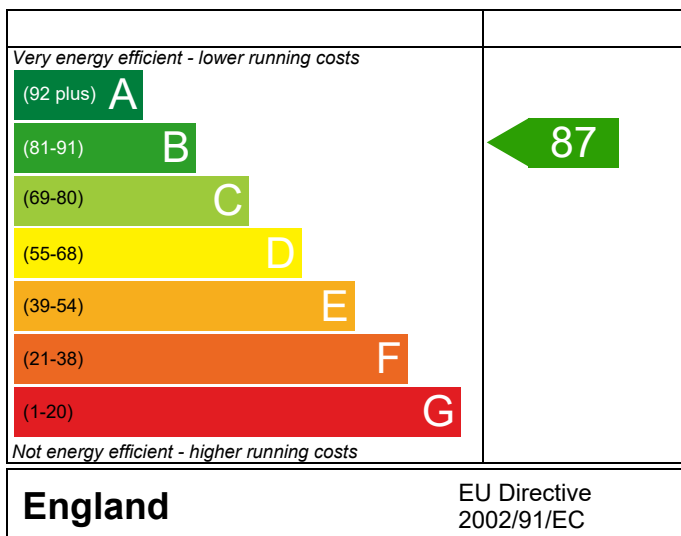
PREDICTED ENERGY ASSESSMENT

Dwelling type: House, Mid-Terrace
Date of assessment: 29/11/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 71.64 m²
DRRN: 8922-3931-7263

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

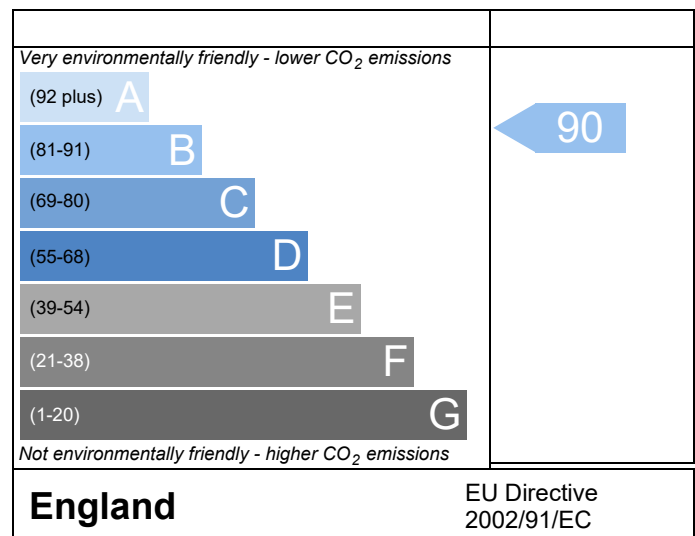
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating



The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

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 Designed)

Property Reference	SAP 0906 Plot 52				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J			
Property						
SAP Rating	87 B	DER	14.61	TER	18.26	
Environmental	90 B	% DER<TER	19.97			
CO ₂ Emissions (t/year)	0.77	DFEE	40.29	TFEE	47.96	
General Requirements Compliance	Pass	% DFEE<TFEE	16.00			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.26	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.61	kgCO ₂ /m ²	Pass
	-3.65 (-20.0%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	47.96	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	40.29	kWh/m ² /yr	
	-7.7 (-16.0%)	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	1.18 (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	5.00 (design value)	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 Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi 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

Not applicable

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

7.00 m², No overhang

Windows facing West

3.62 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

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

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 Designed)

10 Key features

Party wall U-value	0.00	W/m ² K
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	0.55	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.

RECOMMENDATIONS

	Typical cost	Typical savings per year	Energy efficiency	Environmental impact	Result
Low energy lights			0	0	Already installed
Solar water heating	£4,000 - £6,000	£82	B 88	A 92	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£82	B 88	A 92	

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 Designed)

Property Reference	SAP 0906 Plot 52				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J			
Property						
SAP Rating	87 B	DER	14.61	TER	18.26	
Environmental	90 B	% DER<TER	19.97			
CO ₂ Emissions (t/year)	0.77	DFEE	40.29	TFEE	47.96	
General Requirements Compliance	Pass	% DFEE<TFEE	16.00			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.093	0.46	0.04	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	1.02	0.07	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	2.73	0.19	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	1.25	0.08	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.061	1.81	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	6.25	0.13	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	22.20	0.36	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	9.16	1.47	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	9.16	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	9.16	0.65	Knauf P16
External wall	E18 Party wall between dwellings	Independently assessed	0.036	10.00	0.36	Knauf P25 Halved
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.055	10.00	0.55	Knauf P27 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	17.66	2.83	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	17.66	0.00	
Party wall	P5 Party wall - Roof (insulation at rafter level)	Independently assessed	0.035	17.66	0.62	Knauf P29 Halved

Total: **7.56** W/mK:
Y-Value: **0.064** W/m²K:

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 52				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J			
Property						
SAP Rating	87 B	DER	14.61	TER	18.26	
Environmental	90 B	% DER<TER	19.97			
CO ₂ Emissions (t/year)	0.77	DFEE	40.29	TFEE	47.96	
General Requirements Compliance	Pass	% DFEE<TFEE	16.00			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com				Assessor ID	E477-0001
Client	Foreman Homes, FORE					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 72 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) 18.26 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.61 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)48.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.3 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	1.18 (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: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi 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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average
Windows facing North: 7.00 m², No overhang
Windows facing West: 3.62 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
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 0.55 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1675 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4175 (18)
Number of sides sheltered					2 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				0.8500 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.3549 (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	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170 (22b)
Effective ac	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
Ground Floor			35.8200	0.1200	4.2984	84.0000	3008.8800 (28a)
Brick and Block	32.9800	10.5900	22.3900	0.2400	5.3736	42.2200	945.3058 (29a)
Tile Hung	12.8200	2.1800	10.6400	0.2400	2.5536	42.2200	449.2208 (29a)
Pitched Roof	35.8200		35.8200	0.1000	3.5820	9.1000	325.9620 (30)
Total net area of external elements Aum(A, m ²)			117.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3329		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Party Wall 2			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			67.5900			9.0000	608.3100 (32c)
Internal Wall 2			72.8500			9.0000	655.6500 (32c)
Internal Floor 1			35.8200			18.0000	644.7600 (32d)
Internal Ceiling 1			35.8200			18.0000	644.7600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 15957.4486 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 222.7450 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.5621 (36)
Total fabric heat loss (33) + (36) = 37.8950 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 35.6016	Feb 35.3666	Mar 35.1363	Apr 34.0547	May 33.8524	Jun 32.9103	Jul 32.9103	Aug 32.7359	Sep 33.2732	Oct 33.8524	Nov 34.2618	Dec 34.6897 (38)
Heat transfer coeff	73.4965	73.2616	73.0313	71.9497	71.7474	70.8053	70.8053	70.6308	71.1682	71.7474	72.1567	72.5847 (39)
Average = Sum(39)m / 12 =												71.9487 (39)
HLP	Jan 1.0259	Feb 1.0226	Mar 1.0194	Apr 1.0043	May 1.0015	Jun 0.9883	Jul 0.9883	Aug 0.9859	Sep 0.9934	Oct 1.0015	Nov 1.0072	Dec 1.0132 (40)
HLP (average)												1.0043 (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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
Daily hot water use	Jan 97.3227	Feb 93.7837	Mar 90.2447	Apr 86.7057	May 83.1667	Jun 79.6277	Jul 79.6277	Aug 83.1667	Sep 86.7057	Oct 90.2447	Nov 93.7837	Dec 97.3227 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Energy content (annual)										Total = Sum (45)m =		1392.0598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.6490	18.9344	19.5386	17.0342	16.3447	14.1043	13.0697	14.9976	15.1768	17.6870	19.3068	20.9659 (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	25.2930	22.8224	25.2312	24.3760	25.1585	24.3123	25.1011	25.1383	24.3470	25.2011	24.4360	25.2811 (61)
Total heat required for water heating calculated for each month												
Solar input	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (62)
	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	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (64)
								Total per year (kWh/year) = Sum (64)m =				1688.7575 (64)
Heat gains from water heating, kWh/month												
	54.3119	47.6768	49.6183	43.8531	42.5204	37.3425	35.2464	39.5293	39.7285	45.5065	48.9057	52.7947 (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	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.9984	16.8742	13.7230	10.3892	7.7661	6.5564	7.0845	9.2086	12.3598	15.6936	18.3168	19.5264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	201.0940	203.1808	197.9223	186.7276	172.5963	159.3149	150.4421	148.3554	153.6138	164.8085	178.9398	192.2212 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264 (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)												
	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109 (71)
Water heating gains (Table 5)												
	72.9999	70.9476	66.6913	60.9071	57.1511	51.8646	47.3742	53.1308	55.1785	61.1647	67.9246	70.9607 (72)
Total internal gains	353.3714	351.2817	338.6156	318.3030	297.7925	278.0150	265.1798	270.9739	281.4313	301.9460	325.4603	342.9874 (73)

6. Solar gains

[Jan]												Gains
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	W
North				7.0000	10.6334		0.6300		0.7000		0.7700	22.7479
West				3.6200	19.6403		0.6300		0.7000		0.7700	21.7284 (80)
Solar gains	44.4763	85.9778	143.8706	220.7459	284.9553	299.1912	281.6915	231.4869	170.2292	102.1844	55.1552	36.8322 (83)
Total gains	397.8477	437.2594	482.4862	539.0489	582.7478	577.2061	546.8713	502.4608	451.6605	404.1304	380.6155	379.8195 (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	60.3107	60.5041	60.6948	61.6073	61.7810	62.6030	62.6030	62.7576	62.2838	61.7810	61.4305	61.0683
alpha	5.0207	5.0336	5.0463	5.1072	5.1187	5.1735	5.1735	5.1838	5.1523	5.1187	5.0954	5.0712
util living area	0.9976	0.9957	0.9896	0.9652	0.8876	0.7229	0.5559	0.6211	0.8704	0.9797	0.9955	0.9981 (86)
MIT	19.7784	19.9047	20.1435	20.4824	20.7782	20.9468	20.9888	20.9809	20.8550	20.4822	20.0785	19.7607 (87)
Th 2	20.0618	20.0645	20.0672	20.0797	20.0821	20.0931	20.0931	20.0951	20.0888	20.0821	20.0773	20.0724 (88)
util rest of house	0.9969	0.9944	0.9862	0.9532	0.8495	0.6426	0.4481	0.5109	0.8122	0.9706	0.9939	0.9976 (89)
MIT 2	18.9412	19.0692	19.3087	19.6505	19.9248	20.0663	20.0897	20.0887	20.0009	19.6562	19.2532	18.9321 (90)
Living area fraction									fLA = Living area / (4) =			0.1904 (91)
MIT	19.1006	19.2283	19.4676	19.8089	20.0873	20.2340	20.2609	20.2586	20.1635	19.8135	19.4104	19.0898 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1006	19.2283	19.4676	19.8089	20.0873	20.2340	20.2609	20.2586	20.1635	19.8135	19.4104	19.0898 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9959	0.9929	0.9834	0.9489	0.8497	0.6560	0.4687	0.5317	0.8178	0.9671	0.9923	0.9968 (94)
Useful gains	396.2266	434.1369	474.4770	511.4923	495.1605	378.6186	256.3171	267.1833	369.3602	390.8229	377.7009	378.5917 (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	1087.7925	1049.7154	947.0416	784.8902	601.7673	398.9140	259.2117	272.5373	431.5304	661.0417	888.2759	1080.7745 (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	514.5250	413.6688	351.5881	196.8465	79.3154	0.0000	0.0000	0.0000	0.0000	201.0428	367.6140	522.4240 (98)
Space heating												2647.0246 (98)
Space heating per m2										(98) / (4) =		36.9490 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													2918.4395	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	514.5250	413.6688	351.5881	196.8465	79.3154	0.0000	0.0000	0.0000	0.0000	201.0428	367.6140	522.4240	(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)	567.2822	456.0846	387.6385	217.0303	87.4481	0.0000	0.0000	0.0000	0.0000	221.6569	405.3076	575.9912	(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	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539	(64)	
Efficiency of water heater (217)m	89.8063	89.7459	89.5973	89.2245	88.4686	87.2000	87.2000	87.2000	87.2000	89.2110	89.6419	89.8343	(217)	
Fuel for water heating, kWh/month	188.8730	166.0818	173.5414	154.5959	151.6055	135.7117	128.7067	143.4891	143.9510	160.4227	170.8442	183.7314	(219)	
Water heating fuel used												1901.5544	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2918.4395	(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)													335.5173	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.55 * 908 * 1.00) =													-399.4559	(233)
Total delivered energy for all uses													4831.0553	(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	2918.4395	0.2160	630.3829	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1901.5544	0.2160	410.7357	(264)
Space and water heating			1041.1187	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	335.5173	0.5190	174.1335	(268)
Energy saving/generation technologies				
PV Unit	-399.4559	0.5190	-207.3176	(269)
Total CO2, kg/year			1046.8596	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6100	(273)

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

DER			14.6100	ZC1
Total Floor Area		TFA	71.6400	
Assumed number of occupants		N	2.2853	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.6337	ZC2
CO2 emissions from cooking, equation (L16)			2.4267	ZC3
Total CO2 emissions			33.6704	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			33.6704	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (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) =	0.1675 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4175 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3549 (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	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170	(22b)				
Effective ac	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869	(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			2.1500	1.0000	2.1500			(26)					
TER Opening Type (Uw = 1.40)			10.6200	1.3258	14.0795			(27)					
Ground Floor			35.8200	0.1300	4.6566			(28a)					
Brick and Block	32.9800	10.5900	22.3900	0.1800	4.0302			(29a)					
Tile Hung	12.8200	2.1800	10.6400	0.1800	1.9152			(29a)					
Pitched Roof	35.8200		35.8200	0.1300	4.6566			(30)					
Total net area of external elements Aum(A, m2)			117.4400					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.4881		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9063	(36)					
Total fabric heat loss						(33) + (36) =	39.3944	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 35.6016	Feb 35.3666	Mar 35.1363	Apr 34.0547	May 33.8524	Jun 32.9103	Jul 32.9103	Aug 32.7359	Sep 33.2732	Oct 33.8524	Nov 34.2618	Dec 34.6897	(38)
Heat transfer coeff	74.9960	74.7611	74.5308	73.4492	73.2468	72.3048	72.3048	72.1303	72.6676	73.2468	73.6562	74.0842	(39)
Average = Sum(39)m / 12 =												73.4482	(39)
HLP	Jan 1.0468	Feb 1.0436	Mar 1.0404	Apr 1.0253	May 1.0224	Jun 1.0093	Jul 1.0093	Aug 1.0068	Sep 1.0143	Oct 1.0224	Nov 1.0281	Dec 1.0341	(40)
HLP (average)												1.0252	(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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
Daily hot water use	Jan 97.3227	Feb 93.7837	Mar 90.2447	Apr 86.7057	May 83.1667	Jun 79.6277	Jul 79.6277	Aug 83.1667	Sep 86.7057	Oct 90.2447	Nov 93.7837	Dec 97.3227 (44)
Energy conte	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Energy content (annual)												Total = Sum(45)m = 1392.0598 (45)
Distribution loss (46)m = 0.15 x (45)m	21.6490	18.9344	19.5386	17.0342	16.3447	14.1043	13.0697	14.9976	15.1768	17.6870	19.3068	20.9659 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	0.0000 (57)
Combi loss	49.5946	43.1662	45.9877	42.7590	42.3808	39.2685	40.5774	42.3808	42.7590	45.9877	46.2495	49.5946	(61)
Total heat required for water heating calculated for each month	193.9214	169.3954	176.2449	156.3204	151.3457	133.2968	127.7085	142.3651	143.9373	163.9013	174.9614	189.3674	(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	193.9214	169.3954	176.2449	156.3204	151.3457	133.2968	127.7085	142.3651	143.9373	163.9013	174.9614	189.3674	(64)
Heat gains from water heating, kWh/month	60.3873	52.7627	54.8074	48.4489	46.8260	41.0815	39.1154	43.8400	44.3315	50.7032	54.3591	58.8731	(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	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9984	16.8742	13.7230	10.3892	7.7661	6.5564	7.0845	9.2086	12.3598	15.6936	18.3168	19.5264	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.0940	203.1808	197.9223	186.7276	172.5963	159.3149	150.4421	148.3554	153.6138	164.8085	178.9398	192.2212	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	(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)	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	(71)
Water heating gains (Table 5)	81.1658	78.5160	73.6659	67.2901	62.9382	57.0577	52.5745	58.9247	61.5716	68.1495	75.4987	79.1305	(72)
Total internal gains	361.5373	358.8500	345.5903	324.6860	303.5796	283.2081	270.3801	276.7678	287.8243	308.9307	333.0344	351.1573	(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				7.0000	10.6334		0.6300	0.7000	0.7700		22.7479 (74)	
West				3.6200	19.6403		0.6300	0.7000	0.7700		21.7284 (80)	
Solar gains	44.4763	85.9778	143.8706	220.7459	284.9553	299.1912	281.6915	231.4869	170.2292	102.1844	55.1552	36.8322 (83)
Total gains	406.0136	444.8278	489.4609	545.4319	588.5349	582.3993	552.0716	508.2546	458.0536	411.1152	388.1897	387.9894 (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, nll,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.3369	66.5453	66.7509	67.7339	67.9210	68.8060	68.8060	68.9724	68.4624	67.9210	67.5435	67.1533	
alpha	5.4225	5.4364	5.4501	5.5156	5.5281	5.5871	5.5871	5.5982	5.5642	5.5281	5.5029	5.4769	
util living area	0.9985	0.9972	0.9927	0.9727	0.9014	0.7367	0.5647	0.6307	0.8832	0.9845	0.9970	0.9988	(86)
MIT	19.8683	19.9839	20.2043	20.5195	20.7978	20.9546	20.9914	20.9848	20.8698	20.5208	20.1463	19.8522	(87)
Th 2	20.0445	20.0472	20.0498	20.0623	20.0647	20.0756	20.0756	20.0776	20.0714	20.0647	20.0599	20.0550	(88)
util rest of house	0.9980	0.9962	0.9900	0.9620	0.8633	0.6525	0.4521	0.5153	0.8238	0.9766	0.9958	0.9984	(89)
MIT 2	18.5268	18.6976	19.0206	19.4824	19.8591	20.0442	20.0723	20.0710	19.9600	19.4911	18.9445	18.5109	(90)
Living area fraction	18.7822	18.9425	19.2460	19.6799	20.0378	20.2176	20.2473	20.2450	20.1332	19.6872	19.1733	18.7663	(92)
Temperature adjustment	18.7822	18.9425	19.2460	19.6799	20.0378	20.2176	20.2473	20.2450	20.1332	19.6872	19.1733	18.7663	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	404.7866	442.4113	482.9783	521.6079	507.3371	388.0798	261.4777	273.0169	379.4930	399.6665	385.8941	387.0716	(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	1086.1090	1049.8304	949.9682	791.7730	610.7175	406.1766	263.7152	277.3394	438.4212	665.6073	889.2766	1079.1305	(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	506.9038	408.1857	347.4405	194.5189	76.9150	0.0000	0.0000	0.0000	0.0000	197.8600	362.4355	514.8919	(98)
Space heating												2609.1511	(98)
Space heating per m2												36.4203	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													2793.5237 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	506.9038	408.1857	347.4405	194.5189	76.9150	0.0000	0.0000	0.0000	0.0000	197.8600	362.4355	514.8919	(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)	542.7236	437.0296	371.9919	208.2643	82.3501	0.0000	0.0000	0.0000	0.0000	211.8415	388.0465	551.2761	(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	193.9214	169.3954	176.2449	156.3204	151.3457	133.2968	127.7085	142.3651	143.9373	163.9013	174.9614	189.3674	(64)
Efficiency of water heater (217)m	87.3596	87.1839	86.7287	85.6027	83.4413	80.3000	80.3000	80.3000	80.3000	85.5262	86.8438	87.4427	(216)
Fuel for water heating, kWh/month	221.9807	194.2966	203.2140	182.6116	181.3798	165.9985	159.0392	177.2915	179.2495	191.6387	201.4669	216.5618	(219)
Water heating fuel used												2274.7288	(219)
Annual totals kWh/year													
Space heating fuel - main system												2793.5237	(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)													335.5173 (232)
Total delivered energy for all uses													5478.7698 (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	2793.5237	0.2160	603.4011 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2274.7288	0.2160	491.3414 (264)
Space and water heating			1094.7425 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.5173	0.5190	174.1335 (268)
Total CO2, kg/m2/year			1307.8010 (272)
Emissions per m2 for space and water heating			15.2812 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4307 (272b)
Emissions per m2 for pumps and fans			0.5433 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2812 * 1.00) + 2.4307 + 0.5433, rounded to 2 d.p.			18.2600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1675 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4175 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3549 (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	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170 (22b)
Effective ac	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
Ground Floor			35.8200	0.1200	4.2984	84.0000	3008.8800 (28a)
Brick and Block	32.9800	10.5900	22.3900	0.2400	5.3736	42.2200	945.3058 (29a)
Tile Hung	12.8200	2.1800	10.6400	0.2400	2.5536	42.2200	449.2208 (29a)
Pitched Roof	35.8200		35.8200	0.1000	3.5820	9.1000	325.9620 (30)
Total net area of external elements Aum(A, m ²)			117.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3329		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Party Wall 2			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			67.5900			9.0000	608.3100 (32c)
Internal Wall 2			72.8500			9.0000	655.6500 (32c)
Internal Floor 1			35.8200			18.0000	644.7600 (32d)
Internal Ceiling 1			35.8200			9.0000	322.3800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15635.0686 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							218.2450 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5621 (36)
Total fabric heat loss						(33) + (36) =	37.8950 (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	35.6016	35.3666	35.1363	34.0547	33.8524	32.9103	32.9103	32.7359	33.2732	33.8524	34.2618	34.6897 (38)
Heat transfer coeff	73.4965	73.2616	73.0313	71.9497	71.7474	70.8053	70.8053	70.6308	71.1682	71.7474	72.1567	72.5847 (39)
Average = Sum(39)m / 12 =												71.9487 (39)
HLP	1.0259	1.0226	1.0194	1.0043	1.0015	0.9883	0.9883	0.9859	0.9934	1.0015	1.0072	1.0132 (40)
HLP (average)												1.0043 (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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.3227	93.7837	90.2447	86.7057	83.1667	79.6277	79.6277	83.1667	86.7057	90.2447	93.7837	97.3227 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Energy content (annual)										Total =	Sum (45)m =	1392.0598 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	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	30.6694	26.8237	27.6797	24.1318	23.1550	19.9810	18.5154	21.2466	21.5004	25.0566	27.3513	29.7017 (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	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9984	16.8742	13.7230	10.3892	7.7661	6.5564	7.0845	9.2086	12.3598	15.6936	18.3168	19.5264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.0940	203.1808	197.9223	186.7276	172.5963	159.3149	150.4421	148.3554	153.6138	164.8085	178.9398	192.2212 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264 (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)	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109 (71)
Water heating gains (Table 5)	41.2224	39.9162	37.2038	33.5164	31.1223	27.7514	24.8862	28.5573	29.8617	33.6783	37.9879	39.9217 (72)
Total internal gains	318.5939	317.2503	306.1282	287.9123	268.7638	250.9018	239.6919	243.4004	253.1144	271.4595	292.5236	308.9484 (73)

6. Solar gains

[Jan]												Gains
	Area				Solar flux		g		FF		Access	W
	m2				Table 6a		or Table 6b		Specific data		factor	
					W/m2				or Table 6c		Table 6d	
North	7.0000				10.6334		0.6300		0.7000		0.7700	22.7479
West	3.6200				19.6403		0.6300		0.7000		0.7700	21.7284 (80)
Solar gains	44.4763	85.9778	143.8706	220.7459	284.9553	299.1912	281.6915	231.4869	170.2292	102.1844	55.1552	36.8322 (83)
Total gains	363.0702	403.2281	449.9988	508.6581	553.7191	550.0930	521.3834	474.8873	423.3437	373.6440	347.6788	345.7806 (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	59.0922	59.2817	59.4686	60.3626	60.5329	61.3383	61.3383	61.4898	61.0255	60.5329	60.1895	59.8345
alpha	4.9395	4.9521	4.9646	5.0242	5.0355	5.0892	5.0892	5.0993	5.0684	5.0355	5.0126	4.9890
util living area	0.9983	0.9968	0.9917	0.9709	0.9015	0.7457	0.5792	0.6496	0.8905	0.9844	0.9968	0.9987 (86)
MIT	19.7071	19.8368	20.0829	20.4343	20.7475	20.9353	20.9856	20.9752	20.8283	20.4316	20.0149	19.6899 (87)
Th 2	20.0618	20.0645	20.0672	20.0797	20.0821	20.0931	20.0931	20.0951	20.0888	20.0821	20.0773	20.0724 (88)
util rest of house	0.9978	0.9958	0.9891	0.9608	0.8668	0.6667	0.4687	0.5376	0.8380	0.9773	0.9956	0.9983 (89)
MIT 2	18.8716	19.0033	19.2503	19.6057	19.8996	20.0596	20.0886	20.0865	19.9813	19.6086	19.1916	18.8630 (90)
Living area fraction									fLA = Living area / (4) =			0.1904 (91)
MIT	19.0307	19.1620	19.4088	19.7635	20.0611	20.2263	20.2594	20.2557	20.1426	19.7653	19.3483	19.0204 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0307	19.1620	19.4088	19.7635	20.0611	20.2263	20.2594	20.2557	20.1426	19.7653	19.3483	19.0204 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9970	0.9945	0.9865	0.9564	0.8658	0.6792	0.4897	0.5586	0.8417	0.9741	0.9943	0.9976 (94)
Ext temp.	361.9751	401.0019	443.9425	486.4708	479.4325	373.6419	255.3396	265.2771	356.3255	363.9588	345.7078	344.9644 (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	1082.6557	1044.8562	942.7469	781.6241	599.8833	398.3730	259.1046	272.3317	430.0388	657.5854	883.7995	1075.7358 (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	536.1864	432.6701	371.1105	212.5104	89.6155	0.0000	0.0000	0.0000	0.0000	218.4582	387.4260	543.6940 (98)
Space heating per m2										(98) / (4) =		2791.6710 (98)
												38.9680 (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	665.5698	523.9592	536.7944	0.0000	0.0000	0.0000	0.0000 (100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8710	0.9282	0.9001	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	579.7162	486.3142	483.1942	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	728.3322	693.0899	640.2762	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	107.0035	153.8412	116.8690	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												377.7137 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	26.7509	38.4603	29.2173	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												94.4284 (107)
Space cooling per m2												1.3181 (108)
Energy for space heating												38.9680 (99)
Energy for space cooling												1.3181 (108)
Total												40.2861 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (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) = 0.1675 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4175 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3549 (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	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170 (22b)
Effective ac	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869 (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
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			10.6200	1.3258	14.0795		(27)
Ground Floor			35.8200	0.1300	4.6566		(28a)
Brick and Block	32.9800	10.5900	22.3900	0.1800	4.0302		(29a)
Tile Hung	12.8200	2.1800	10.6400	0.1800	1.9152		(29a)
Pitched Roof	35.8200		35.8200	0.1300	4.6566		(30)
Total net area of external elements Aum(A, m ²)			117.4400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	31.4881	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.9063 (36)
Total fabric heat loss						(33) + (36) =	39.3944 (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	35.6016	35.3666	35.1363	34.0547	33.8524	32.9103	32.9103	32.7359	33.2732	33.8524	34.2618	34.6897 (38)
Heat transfer coeff	74.9960	74.7611	74.5308	73.4492	73.2468	72.3048	72.3048	72.1303	72.6676	73.2468	73.6562	74.0842 (39)
Average = Sum(39)m / 12 =												73.4482 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0468	1.0436	1.0404	1.0253	1.0224	1.0093	1.0093	1.0068	1.0143	1.0224	1.0281	1.0341 (40)
HLP (average)												1.0252 (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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.3227	93.7837	90.2447	86.7057	83.1667	79.6277	79.6277	83.1667	86.7057	90.2447	93.7837	97.3227 (44)
Energy conte	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Energy content (annual)										Total = Sum(45)m =		1392.0598 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water 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 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (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 (59)	
Heat gains from water heating, kWh/month	30.6694	26.8237	27.6797	24.1318	23.1550	19.9810	18.5154	21.2466	21.5004	25.0566	27.3513 (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
	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636	114.2636 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9984	16.8742	13.7230	10.3892	7.7661	6.5564	7.0845	9.2086	12.3598	15.6936	18.3168	19.5264 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.0940	203.1808	197.9223	186.7276	172.5963	159.3149	150.4421	148.3554	153.6138	164.8085	178.9398	192.2212 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264	34.4264 (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)	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109 (71)
Water heating gains (Table 5)	41.2224	39.9162	37.2038	33.5164	31.1223	27.7514	24.8862	28.5573	29.8617	33.6783	37.9879	39.9217 (72)
Total internal gains	318.5939	317.2503	306.1282	287.9123	268.7638	250.9018	239.6919	243.4004	253.1144	271.4595	292.5236	308.9484 (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				7.0000	10.6334		0.6300		0.7000		0.7700	22.7479 (74)
West				3.6200	19.6403		0.6300		0.7000		0.7700	21.7284 (80)

Solar gains	44.4763	85.9778	143.8706	220.7459	284.9553	299.1912	281.6915	231.4869	170.2292	102.1844	55.1552	36.8322 (83)
Total gains	363.0702	403.2281	449.9988	508.6581	553.7191	550.0930	521.3834	474.8873	423.3437	373.6440	347.6788	345.7806 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Th1 (C)												
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	66.3369	66.5453	66.7509	67.7339	67.9210	68.8060	68.8060	68.9724	68.4624	67.9210	67.5435	67.1533
alpha	5.4225	5.4364	5.4501	5.5156	5.5281	5.5871	5.5871	5.5982	5.5642	5.5281	5.5029	5.4769
util living area	0.9991	0.9983	0.9951	0.9798	0.9197	0.7664	0.5945	0.6675	0.9095	0.9900	0.9983	0.9994 (86)
MIT	19.8114	19.9290	20.1534	20.4764	20.7692	20.9447	20.9890	20.9800	20.8436	20.4741	20.0927	19.7960 (87)
Th 2	20.0445	20.0472	20.0498	20.0623	20.0647	20.0756	20.0756	20.0776	20.0714	20.0647	20.0599	20.0550 (88)
util rest of house	0.9988	0.9976	0.9932	0.9714	0.8862	0.6834	0.4777	0.5489	0.8579	0.9846	0.9975	0.9991 (89)
MIT 2	18.9514	19.0711	19.2968	19.6254	19.9010	20.0488	20.0726	20.0715	19.9763	19.6280	19.2451	18.9446 (90)
Living area fraction									fLA = Living area / (4) =			0.1904 (91)
MIT	19.1152	19.2344	19.4599	19.7874	20.0663	20.2193	20.2471	20.2444	20.1414	19.7891	19.4065	19.1067 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1152	19.2344	19.4599	19.7874	20.0663	20.2193	20.2471	20.2444	20.1414	19.7891	19.4065	19.1067 (93)

8. Space heating requirement												

Utilisation	0.9984	0.9969	0.9916	0.9683	0.8863	0.6975	0.5002	0.5716	0.8626	0.9824	0.9968	0.9988 (94)
Useful gains	362.5020	401.9876	446.2310	492.5483	490.7562	383.6891	260.7786	271.4553	365.1892	367.0808	346.5778	345.3695 (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	1111.0774	1071.6577	965.9116	799.6719	612.8048	406.3049	263.7023	277.3009	439.0173	673.0712	906.4500	1104.3522 (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	556.9401	450.0183	386.6423	221.1290	90.8041	0.0000	0.0000	0.0000	0.0000	227.6569	403.1080	564.6831 (98)
Space heating												2900.9819 (98)
Space heating per m2										(98) / (4) =		40.4939 (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	679.6648	535.0552	548.1903	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8759	0.9344	0.9059	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	595.3240	499.9329	496.6254	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	728.3322	693.0899	640.2762	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	95.7659	143.7089	106.8762	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												346.3510 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	23.9415	35.9272	26.7191	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												86.5878 (107)
Space cooling per m2												1.2087 (108)
Energy for space heating												40.4939 (99)
Energy for space cooling												1.2087 (108)
Total												41.7025 (109)
Target Fabric Energy Efficiency (TFEE)												48.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (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) = 0.1675 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4175 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3549 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4525	0.4170	0.4081	0.3815	0.3815	0.3549	0.3549	0.3460	0.3549	0.3992	0.3904	0.4170 (22b)
Effective ac	0.6024	0.5869	0.5833	0.5728	0.5728	0.5630	0.5630	0.5599	0.5630	0.5797	0.5762	0.5869 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
Ground Floor			35.8200	0.1200	4.2984	84.0000	3008.8800 (28a)
Brick and Block	32.9800	10.5900	22.3900	0.2400	5.3736	42.2200	945.3058 (29a)
Tile Hung	12.8200	2.1800	10.6400	0.2400	2.5536	42.2200	449.2208 (29a)
Pitched Roof	35.8200		35.8200	0.1000	3.5820	9.1000	325.9620 (30)
Total net area of external elements Aum(A, m ²)			117.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3329		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Party Wall 2			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			67.5900			9.0000	608.3100 (32c)
Internal Wall 2			72.8500			9.0000	655.6500 (32c)
Internal Floor 1			35.8200			18.0000	644.7600 (32d)
Internal Ceiling 1			35.8200			18.0000	644.7600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15957.4486 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							222.7450 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5621 (36)
Total fabric heat loss						(33) + (36) =	37.8950 (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	35.6016	34.6897	34.4734	33.8524	33.8524	33.2732	33.2732	33.0894	33.2732	34.2618	34.0547	34.6897 (38)
Heat transfer coeff	73.4965	72.5847	72.3684	71.7474	71.7474	71.1682	71.1682	70.9844	71.1682	72.1567	71.9497	72.5847 (39)
Average = Sum(39)m / 12 =												71.9270 (39)
HLP	1.0259	1.0132	1.0102	1.0015	1.0015	0.9934	0.9934	0.9908	0.9934	1.0072	1.0043	1.0132 (40)
HLP (average)												1.0040 (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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.3227	93.7837	90.2447	86.7057	83.1667	79.6277	79.6277	83.1667	86.7057	90.2447	93.7837	97.3227 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Distribution loss (46)m = 0.15 x (45)m	21.6490	18.9344	19.5386	17.0342	16.3447	14.1043	13.0697	14.9976	15.1768	17.6870	19.3068	20.9659 (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	25.2930	22.8224	25.2312	24.3760	25.1585	24.3123	25.1011	25.1383	24.3470	25.2011	24.4360	25.2811 (61)
Total heat required for water heating calculated for each month	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (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	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (64)
RHI water heating demand	54.3119	47.6768	49.6183	43.8531	42.5204	37.3425	35.2464	39.5293	39.7285	45.5065	48.9057	52.7947 (65)
Heat gains from water heating, kWh/month												
	54.3119	47.6768	49.6183	43.8531	42.5204	37.3425	35.2464	39.5293	39.7285	45.5065	48.9057	52.7947 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4959	42.1855	34.3075	25.9730	19.4151	16.3911	17.7111	23.0216	30.8995	39.2341	45.7919	48.8160 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.1404	303.2549	295.4064	278.6979	257.6064	237.7834	224.5404	221.4259	229.2744	245.9829	267.0744	286.8974 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969 (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)	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109 (71)
Water heating gains (Table 5)	72.9999	70.9476	66.6913	60.9071	57.1511	51.8646	47.3742	53.1308	55.1785	61.1647	67.9246	70.9607 (72)
Total internal gains	520.3386	516.0903	496.1075	465.2804	433.8750	405.7414	389.3281	397.2807	415.0548	446.0840	480.4933	506.3764 (73)

6. Solar gains

[Jan]												Gains	
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
North	7.0000				13.8645		0.6300		0.7000		0.7700		29.6603
West	3.6200				25.9136		0.6300		0.7000		0.7700		28.6688 (74)
Solar gains	58.3291	96.9060	162.0911	253.3546	311.6175	353.4537	325.0846	273.5528	203.5065	122.0916	71.7975	46.0426	(83)
Total gains	578.6676	612.9963	658.1986	718.6350	745.4925	759.1951	714.4126	670.8335	618.5613	568.1756	552.2908	552.4189	(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	60.3107	61.0683	61.2508	61.7810	61.7810	62.2838	62.2838	62.4450	62.2838	61.4305	61.6073	61.0683
alpha	5.0207	5.0712	5.0834	5.1187	5.1187	5.1523	5.1523	5.1630	5.1523	5.0954	5.1072	5.0712
util living area	0.9837	0.9774	0.9543	0.8856	0.7368	0.5158	0.3672	0.3896	0.6550	0.8936	0.9673	0.9860 (86)
MIT	20.1508	20.2458	20.4639	20.7317	20.9210	20.9897	20.9986	20.9981	20.9677	20.7694	20.4499	20.1441 (87)
Th 2	20.0618	20.0724	20.0749	20.0821	20.0821	20.0888	20.0888	20.0910	20.0888	20.0773	20.0797	20.0724 (88)
util rest of house	0.9791	0.9710	0.9414	0.8550	0.6767	0.4359	0.2775	0.2949	0.5695	0.8561	0.9565	0.9819 (89)
MIT 2	19.3101	19.4117	19.6249	19.8786	20.0343	20.0848	20.0885	20.0906	20.0742	19.9136	19.6186	19.3124 (90)
Living area fraction									fLA = Living area / (4) =			0.1904 (91)
MIT	19.4702	19.5705	19.7847	20.0410	20.2031	20.2571	20.2618	20.2634	20.2443	20.0766	19.7769	19.4707 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4702	19.5705	19.7847	20.0410	20.2031	20.2571	20.2618	20.2634	20.2443	20.0766	19.7769	19.4707 (93)

8. Space heating requirement

Utilisation	0.9754	0.9668	0.9365	0.8534	0.6852	0.4510	0.2947	0.3130	0.5848	0.8560	0.9521	0.9785 (94)
Useful gains	564.4192	592.6286	616.4023	613.3085	510.7878	342.3749	210.5099	209.9910	361.7525	486.3828	525.8131	540.5681 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	1034.1091	1006.7861	903.4950	749.1153	545.5055	345.6693	210.7860	210.3536	373.2274	597.2103	818.5630	1014.0628 (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	349.4492	278.3139	213.5970	97.7810	25.8300	0.0000	0.0000	0.0000	0.0000	82.4557	210.7800	352.2801 (98)
Space heating												1610.4867 (98)
RHI space heating demand												1610 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (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) = 0.1675 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4175 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3549 (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	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170 (22b)
Effective ac	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
Ground Floor			35.8200	0.1200	4.2984	84.0000	3008.8800 (28a)
Brick and Block	32.9800	10.5900	22.3900	0.2400	5.3736	42.2200	945.3058 (29a)
Tile Hung	12.8200	2.1800	10.6400	0.2400	2.5536	42.2200	449.2208 (29a)
Pitched Roof	35.8200		35.8200	0.1000	3.5820	9.1000	325.9620 (30)
Total net area of external elements Aum(A, m ²)			117.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3329		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Party Wall 2			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			67.5900			9.0000	608.3100 (32c)
Internal Wall 2			72.8500			9.0000	655.6500 (32c)
Internal Floor 1			35.8200			18.0000	644.7600 (32d)
Internal Ceiling 1			35.8200			18.0000	644.7600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15957.4486 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							222.7450 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5621 (36)
Total fabric heat loss						(33) + (36) =	37.8950 (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	35.6016	35.3666	35.1363	34.0547	33.8524	32.9103	32.9103	32.7359	33.2732	33.8524	34.2618	34.6897 (38)
Heat transfer coeff	73.4965	73.2616	73.0313	71.9497	71.7474	70.8053	70.8053	70.6308	71.1682	71.7474	72.1567	72.5847 (39)
Average = Sum(39)m / 12 =												71.9487 (39)
HLP	1.0259	1.0226	1.0194	1.0043	1.0015	0.9883	0.9883	0.9859	0.9934	1.0015	1.0072	1.0132 (40)
HLP (average)												1.0043 (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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.3227	93.7837	90.2447	86.7057	83.1667	79.6277	79.6277	83.1667	86.7057	90.2447	93.7837	97.3227 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Energy content (annual)	Total = Sum (45)m =											1392.0598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.6490	18.9344	19.5386	17.0342	16.3447	14.1043	13.0697	14.9976	15.1768	17.6870	19.3068	20.9659 (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	25.2930	22.8224	25.2312	24.3760	25.1585	24.3123	25.1011	25.1383	24.3470	25.2011	24.4360	25.2811 (61)
Total heat required for water heating calculated for each month												
Solar input	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (62)
	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	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (64)
	Total per year (kWh/year) = Sum (64)m =											1688.7575 (64)
Heat gains from water heating, kWh/month												
	54.3119	47.6768	49.6183	43.8531	42.5204	37.3425	35.2464	39.5293	39.7285	45.5065	48.9057	52.7947 (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	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4959	42.1855	34.3075	25.9730	19.4151	16.3911	17.7111	23.0216	30.8995	39.2341	45.7919	48.8160 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.1404	303.2549	295.4064	278.6979	257.6064	237.7834	224.5404	221.4259	229.2744	245.9829	267.0744	286.8974 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969 (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)	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109 (71)
Water heating gains (Table 5)	72.9999	70.9476	66.6913	60.9071	57.1511	51.8646	47.3742	53.1308	55.1785	61.1647	67.9246	70.9607 (72)
Total internal gains	520.3386	516.0903	496.1075	465.2804	433.8750	405.7414	389.3281	397.2807	415.0548	446.0840	480.4933	506.3764 (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				7.0000	10.6334	0.6300	0.7000	0.7700	22.7479 (74)			
West				3.6200	19.6403	0.6300	0.7000	0.7700	21.7284 (80)			
Solar gains	44.4763	85.9778	143.8706	220.7459	284.9553	299.1912	281.6915	231.4869	170.2292	102.1844	55.1552	36.8322 (83)
Total gains	564.8149	602.0681	639.9781	686.0263	718.8303	704.9326	671.0196	628.7675	585.2841	548.2685	535.6485	543.2085 (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	60.3107	60.5041	60.6948	61.6073	61.7810	62.6030	62.6030	62.7576	62.2838	61.7810	61.4305	61.0683
alpha	5.0207	5.0336	5.0463	5.1072	5.1187	5.1735	5.1735	5.1838	5.1523	5.1187	5.0954	5.0712
util living area	0.9889	0.9831	0.9673	0.9181	0.8039	0.6179	0.4595	0.5084	0.7562	0.9354	0.9805	0.9907 (86)
MIT	20.0162	20.1351	20.3520	20.6443	20.8679	20.9739	20.9953	20.9923	20.9282	20.6551	20.2945	19.9953 (87)
Th 2	20.0618	20.0645	20.0672	20.0797	20.0821	20.0931	20.0931	20.0951	20.0888	20.0821	20.0773	20.0724 (88)
util rest of house	0.9859	0.9785	0.9580	0.8950	0.7541	0.5400	0.3672	0.4125	0.6832	0.9123	0.9743	0.9882 (89)
MIT 2	19.1769	19.2964	19.5108	19.7985	19.9943	20.0808	20.0917	20.0927	20.0498	19.8158	19.4652	19.1649 (90)
Living area fraction	19.3367	19.4561	19.6710	19.9595	20.1607	20.2509	20.2638	20.2640	20.2171	19.9756	19.6231	19.3230 (92)
MIT	19.3367	19.4561	19.6710	19.9595	20.1607	20.2509	20.2638	20.2640	20.2171	19.9756	19.6231	19.3230 (93)
Temperature adjustment												0.0000
adjusted MIT	19.3367	19.4561	19.6710	19.9595	20.1607	20.2509	20.2638	20.2640	20.2171	19.9756	19.6231	19.3230 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	555.1489	586.8325	610.0274	611.6151	545.3737	390.5848	258.2452	270.8632	406.3782	498.4006	519.8065	535.3536 (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	1105.1442	1066.3998	961.8945	795.7276	607.0297	400.1111	259.4137	272.9161	435.3399	672.6719	903.6283	1097.7011 (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	409.1965	322.2692	261.7891	132.5610	45.8720	0.0000	0.0000	0.0000	0.0000	129.6579	276.3517	418.3865 (98)
Space heating												1996.0840 (98)
Space heating per m2												(98) / (4) = 27.8627 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													2200.7541	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	409.1965	322.2692	261.7891	132.5610	45.8720	0.0000	0.0000	0.0000	0.0000	129.6579	276.3517	418.3865	(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)	451.1538	355.3134	288.6319	146.1533	50.5756	0.0000	0.0000	0.0000	0.0000	142.9525	304.6877	461.2861	(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	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539	(64)	
Efficiency of water heater (217)m	89.6456	89.5632	89.3635	88.8808	88.0661	87.2000	87.2000	87.2000	87.2000	88.8294	89.4202	89.6817	(217)	
Fuel for water heating, kWh/month	189.2116	166.4206	173.9954	155.1936	152.2985	135.7117	128.7067	143.4891	143.9510	161.1119	171.2677	184.0441	(219)	
Water heating fuel used													1905.4020	(219)
Annual totals kWh/year														
Space heating fuel - main system													2200.7541	(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)													335.5173	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.55 * 908 * 1.00) =										-399.4559			-399.4559	(233)
Total delivered energy for all uses													4117.2176	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2200.7541	3.4800	76.5862 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1905.4020	3.4800	66.3080 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	335.5173	13.1900	44.2547 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-399.4559	13.1900	-52.6882 (252)
Total energy cost			264.3532 (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] =	0.9519 (257)
SAP value		86.7211
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2200.7541	0.2160	475.3629 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1905.4020	0.2160	411.5668 (264)
Space and water heating			886.9297 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.5173	0.5190	174.1335 (268)
Energy saving/generation technologies			
PV Unit	-399.4559	0.5190	-207.3176 (269)
Total kg/year			892.6706 (272)
CO2 emissions per m2			12.4600 (273)
EI value			89.7447
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8852 = 3.931$, stars = 4
Water heating environmental impact	$0.216 / 0.8852 = 0.2440$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (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) = 0.1675 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4175 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3549 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4525	0.4170	0.4081	0.3815	0.3815	0.3549	0.3549	0.3460	0.3549	0.3992	0.3904	0.4170 (22b)
Effective ac	0.6024	0.5869	0.5833	0.5728	0.5728	0.5630	0.5630	0.5599	0.5630	0.5797	0.5762	0.5869 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
Ground Floor			35.8200	0.1200	4.2984	84.0000	3008.8800 (28a)
Brick and Block	32.9800	10.5900	22.3900	0.2400	5.3736	42.2200	945.3058 (29a)
Tile Hung	12.8200	2.1800	10.6400	0.2400	2.5536	42.2200	449.2208 (29a)
Pitched Roof	35.8200		35.8200	0.1000	3.5820	9.1000	325.9620 (30)
Total net area of external elements Aum(A, m ²)			117.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3329		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Party Wall 2			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			67.5900			9.0000	608.3100 (32c)
Internal Wall 2			72.8500			9.0000	655.6500 (32c)
Internal Floor 1			35.8200			18.0000	644.7600 (32d)
Internal Ceiling 1			35.8200			18.0000	644.7600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15957.4486 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							222.7450 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5621 (36)
Total fabric heat loss						(33) + (36) =	37.8950 (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	35.6016	34.6897	34.4734	33.8524	33.8524	33.2732	33.2732	33.0894	33.2732	34.2618	34.0547	34.6897 (38)
Heat transfer coeff	73.4965	72.5847	72.3684	71.7474	71.7474	71.1682	71.1682	70.9844	71.1682	72.1567	71.9497	72.5847 (39)
Average = Sum(39)m / 12 =												71.9270 (39)
HLP	1.0259	1.0132	1.0102	1.0015	1.0015	0.9934	0.9934	0.9908	0.9934	1.0072	1.0043	1.0132 (40)
HLP (average)												1.0040 (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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.3227	93.7837	90.2447	86.7057	83.1667	79.6277	79.6277	83.1667	86.7057	90.2447	93.7837	97.3227 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Energy content (annual)										Total =	Sum(45)m =	1392.0598 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.6490	18.9344	19.5386	17.0342	16.3447	14.1043	13.0697	14.9976	15.1768	17.6870	19.3068	20.9659 (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	25.2930	22.8224	25.2312	24.3760	25.1585	24.3123	25.1011	25.1383	24.3470	25.2011	24.4360	25.2811 (61)
Total heat required for water heating calculated for each month												
Solar input	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (62)
	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	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum(64)m =			1688.7575 (64)
	54.3119	47.6768	49.6183	43.8531	42.5204	37.3425	35.2464	39.5293	39.7285	45.5065	48.9057	52.7947 (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	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	47.4959	42.1855	34.3075	25.9730	19.4151	16.3911	17.7111	23.0216	30.8995	39.2341	45.7919	48.8160 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	300.1404	303.2549	295.4064	278.6979	257.6064	237.7834	224.5404	221.4259	229.2744	245.9829	267.0744	286.8974 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969 (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)												
	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109 (71)
Water heating gains (Table 5)												
	72.9999	70.9476	66.6913	60.9071	57.1511	51.8646	47.3742	53.1308	55.1785	61.1647	67.9246	70.9607 (72)
Total internal gains	520.3386	516.0903	496.1075	465.2804	433.8750	405.7414	389.3281	397.2807	415.0548	446.0840	480.4933	506.3764 (73)

6. Solar gains

[Jan]												Gains
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		W
North				7.0000	13.8645		0.6300	0.7000		0.7700		29.6603 (74)
West				3.6200	25.9136		0.6300	0.7000		0.7700		28.6688 (80)
Solar gains	58.3291	96.9060	162.0911	253.3546	311.6175	353.4537	325.0846	273.5528	203.5065	122.0916	71.7975	46.0426 (83)
Total gains	578.6676	612.9963	658.1986	718.6350	745.4925	759.1951	714.4126	670.8335	618.5613	568.1756	552.2908	552.4189 (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	60.3107	61.0683	61.2508	61.7810	61.7810	62.2838	62.2838	62.4450	62.2838	61.4305	61.6073	61.0683
alpha	5.0207	5.0712	5.0834	5.1187	5.1187	5.1523	5.1523	5.1630	5.1523	5.0954	5.1072	5.0712
util living area	0.9837	0.9774	0.9543	0.8856	0.7368	0.5158	0.3672	0.3896	0.6550	0.8936	0.9673	0.9860 (86)
MIT	20.1508	20.2458	20.4639	20.7317	20.9210	20.9897	20.9986	20.9981	20.9677	20.7694	20.4499	20.1441 (87)
Th 2	20.0618	20.0724	20.0749	20.0821	20.0821	20.0888	20.0888	20.0910	20.0888	20.0773	20.0797	20.0724 (88)
util rest of house												
	0.9791	0.9710	0.9414	0.8550	0.6767	0.4359	0.2775	0.2949	0.5695	0.8561	0.9565	0.9819 (89)
MIT 2	19.3101	19.4117	19.6249	19.8786	20.0343	20.0848	20.0885	20.0906	20.0742	19.9136	19.6186	19.3124 (90)
Living area fraction												
MIT	19.4702	19.5705	19.7847	20.0410	20.2031	20.2571	20.2618	20.2634	20.2443	20.0766	19.7769	19.4707 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4702	19.5705	19.7847	20.0410	20.2031	20.2571	20.2618	20.2634	20.2443	20.0766	19.7769	19.4707 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9754	0.9668	0.9365	0.8534	0.6852	0.4510	0.2947	0.3130	0.5848	0.8560	0.9521	0.9785 (94)
Useful gains	564.4192	592.6286	616.4023	613.3085	510.7878	342.3749	210.5099	209.9910	361.7525	486.3828	525.8131	540.5681 (95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000 (96)
Heat loss rate W	1034.1091	1006.7861	903.4950	749.1153	545.5055	345.6693	210.7860	210.3536	373.2274	597.2103	818.5630	1014.0628 (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	349.4492	278.3139	213.5970	97.7810	25.8300	0.0000	0.0000	0.0000	0.0000	82.4557	210.7800	352.2801 (98)
Space heating												1610.4867 (98)
Space heating per m2										(98) / (4) =		22.4803 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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													1775.6193 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	349.4492	278.3139	213.5970	97.7810	25.8300	0.0000	0.0000	0.0000	0.0000	82.4557	210.7800	352.2801	(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)	385.2803	306.8510	235.4983	107.8070	28.4785	0.0000	0.0000	0.0000	0.0000	90.9103	232.3925	388.4014	(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	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539	(64)
Efficiency of water heater (217)m	89.5258	89.4478	89.1918	88.6186	87.7468	87.2000	87.2000	87.2000	87.2000	88.4476	89.1935	89.5532	(216)
Fuel for water heating, kWh/month	189.4648	166.6352	174.3302	155.6529	152.8526	135.7117	128.7067	143.4891	143.9510	161.8073	171.7031	184.3082	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													1775.6193 (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)													335.5173 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.55 * 1054 * 1.00) =										-463.9548			-463.9548 (233)
Total delivered energy for all uses													3630.7946 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1775.6193	10.2300	181.6459 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1908.6128	10.2300	195.2511 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	335.5173	36.7200	123.2020 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-463.9548	36.7200	-170.3642 (252)
Total energy cost			460.2747 (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	1775.6193	0.2160	383.5338 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1908.6128	0.2160	412.2604 (264)
Space and water heating			795.7941 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	335.5173	0.5190	174.1335 (268)
Energy saving/generation technologies			
PV Unit	-463.9548	0.5190	-240.7925 (269)
Total kg/year			768.0601 (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	1775.6193	1.2200	2166.2556 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1908.6128	1.2200	2328.5076 (264)
Space and water heating			4494.7632 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	335.5173	3.0700	1030.0381 (268)
Energy saving/generation technologies			
PV Unit	-463.9548	3.0700	-1424.3412 (269)
Primary energy kWh/year			4330.7101 (272)
Primary energy kWh/m2/year			60.4510 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(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	-£ 82	-186 kg (24.2%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£82	2.60 kg/m²	B 88	A 92
Total Savings	£82	2.60 kg/m²		
Potential energy efficiency rating:			B 88	
Potential environmental impact rating:				A 92

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
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	£151	£169	-£18
Mains gas	£480	£379	£100
Space heating	£312	£312	£0
Water heating	£195	£113	£82
Lighting	£123	£123	£0
Generated (PV)	-£170	-£170	£0
Total cost of fuels	£461	£378	£82
Total cost of uses	£460	£378	£82
Delivered energy	51 kWh/m²	38 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	3 kg/m²
Primary energy	60 kWh/m²	46 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1675 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4175 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3549 (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	0.4525	0.4436	0.4347	0.3904	0.3815	0.3371	0.3371	0.3283	0.3549	0.3815	0.3992	0.4170 (22b)
Effective ac	0.6024	0.5984	0.5945	0.5762	0.5728	0.5568	0.5568	0.5539	0.5630	0.5728	0.5797	0.5869 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
Ground Floor			35.8200	0.1200	4.2984	84.0000	3008.8800 (28a)
Brick and Block	32.9800	10.5900	22.3900	0.2400	5.3736	42.2200	945.3058 (29a)
Tile Hung	12.8200	2.1800	10.6400	0.2400	2.5536	42.2200	449.2208 (29a)
Pitched Roof	35.8200		35.8200	0.1000	3.5820	9.1000	325.9620 (30)
Total net area of external elements Aum(A, m ²)			117.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3329		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Party Wall 2			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			67.5900			9.0000	608.3100 (32c)
Internal Wall 2			72.8500			9.0000	655.6500 (32c)
Internal Floor 1			35.8200			18.0000	644.7600 (32d)
Internal Ceiling 1			35.8200			18.0000	644.7600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15957.4486 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							222.7450 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5621 (36)
Total fabric heat loss						(33) + (36) =	37.8950 (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	35.6016	35.3666	35.1363	34.0547	33.8524	32.9103	32.9103	32.7359	33.2732	33.8524	34.2618	34.6897 (38)
Heat transfer coeff	73.4965	73.2616	73.0313	71.9497	71.7474	70.8053	70.8053	70.6308	71.1682	71.7474	72.1567	72.5847 (39)
Average = Sum(39)m / 12 =												71.9487 (39)
HLP	1.0259	1.0226	1.0194	1.0043	1.0015	0.9883	0.9883	0.9859	0.9934	1.0015	1.0072	1.0132 (40)
HLP (average)												1.0043 (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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.3227	93.7837	90.2447	86.7057	83.1667	79.6277	79.6277	83.1667	86.7057	90.2447	93.7837	97.3227 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Distribution loss (46)m = 0.15 x (45)m	21.6490	18.9344	19.5386	17.0342	16.3447	14.1043	13.0697	14.9976	15.1768	17.6870	19.3068	20.9659 (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	25.2930	22.8224	25.2312	24.3760	25.1585	24.3123	25.1011	25.1383	24.3470	25.2011	24.4360	25.2811 (61)
Total heat required for water heating calculated for each month	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (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												1.3028 (H8)
Utilisation factor												0.5359 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.4752 (H14)
Volume ratio Veff/V												0.8477 (H15)
Solar storage volume factor												0.9670 (H16)
Solar input												-826.2881 (H17)
Solar input	-23.9607	-39.9835	-68.0965	-91.2628	-112.7475	-110.8487	-109.3838	-95.5692	-74.8498	-51.1136	-28.4208	-20.0510 (63)
Solar input (sum of months) = Sum (63)m =												-826.2881 (63)
Output from w/h	145.6591	109.0680	87.3918	46.6745	21.3758	7.4919	2.8484	29.5533	50.6755	92.0011	124.7271	145.0029 (64)
Total per year (kWh/year) = Sum (64)m =												862.4694 (64)
Heat gains from water heating, kWh/month	54.3119	47.6768	49.6183	43.8531	42.5204	37.3425	35.2464	39.5293	39.7285	45.5065	48.9057	52.7947 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4959	42.1855	34.3075	25.9730	19.4151	16.3911	17.7111	23.0216	30.8995	39.2341	45.7919	48.8160	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.1404	303.2549	295.4064	278.6979	257.6064	237.7834	224.5404	221.4259	229.2744	245.9829	267.0744	286.8974	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	(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)	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	(71)
Water heating gains (Table 5)	72.9999	70.9476	66.6913	60.9071	57.1511	51.8646	47.3742	53.1308	55.1785	61.1647	67.9246	70.9607	(72)
Total internal gains	520.3386	516.0903	496.1075	465.2804	433.8750	405.7414	389.3281	397.2807	415.0548	446.0840	480.4933	506.3764	(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	7.0000	10.6334	0.6300	0.7000	0.7700	22.7479	(74)
West	3.6200	19.6403	0.6300	0.7000	0.7700	21.7284	(80)

Solar gains	44.4763	85.9778	143.8706	220.7459	284.9553	299.1912	281.6915	231.4869	170.2292	102.1844	55.1552	36.8322	(83)
Total gains	564.8149	602.0681	639.9781	686.0263	718.8303	704.9326	671.0196	628.7675	585.2841	548.2685	535.6485	543.2085	(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	60.3107	60.5041	60.6948	61.6073	61.7810	62.6030	62.6030	62.7576	62.2838	61.7810	61.4305	61.0683		
util living area	5.0207	5.0336	5.0463	5.1072	5.1187	5.1735	5.1735	5.1838	5.1523	5.1187	5.0954	5.0712		
	0.9889	0.9831	0.9673	0.9181	0.8039	0.6179	0.4595	0.5084	0.7562	0.9354	0.9805	0.9907	(86)	
MIT	20.0162	20.1351	20.3520	20.6443	20.8679	20.9739	20.9953	20.9923	20.9282	20.6551	20.2945	19.9953	(87)	
Th 2	20.0618	20.0645	20.0672	20.0797	20.0821	20.0931	20.0931	20.0951	20.0888	20.0821	20.0773	20.0724	(88)	
util rest of house	0.9859	0.9785	0.9580	0.8950	0.7541	0.5400	0.3672	0.4125	0.6832	0.9123	0.9743	0.9882	(89)	
MIT 2	19.1769	19.2964	19.5108	19.7985	19.9943	20.0808	20.0917	20.0927	20.0498	19.8158	19.4652	19.1649	(90)	
Living area fraction									fLA = Living area / (4) =			0.1904	(91)	
MIT	19.3367	19.4561	19.6710	19.9595	20.1607	20.2509	20.2638	20.2640	20.2171	19.9756	19.6231	19.3230	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.3367	19.4561	19.6710	19.9595	20.1607	20.2509	20.2638	20.2640	20.2171	19.9756	19.6231	19.3230	(93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	0.9829	0.9747	0.9532	0.8915	0.7587	0.5541	0.3849	0.4308	0.6943	0.9090	0.9704	0.9855	(94)
Useful gains	555.1489	586.8325	610.0274	611.6151	545.3737	390.5848	258.2452	270.8632	406.3782	498.4006	519.8065	535.3536	(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													
	1105.1442	1066.3998	961.8945	795.7276	607.0297	400.1111	259.4137	272.9161	435.3399	672.6719	903.6283	1097.7011	(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													
	409.1965	322.2692	261.7891	132.5610	45.8720	0.0000	0.0000	0.0000	0.0000	129.6579	276.3517	418.3865	(98)
Space heating													1996.0840 (98)
Space heating per m2											(98) / (4) =	27.8627	(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													2200.7541	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	409.1965	322.2692	261.7891	132.5610	45.8720	0.0000	0.0000	0.0000	0.0000	129.6579	276.3517	418.3865	(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)	451.1538	355.3134	288.6319	146.1533	50.5756	0.0000	0.0000	0.0000	0.0000	142.9525	304.6877	461.2861	(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	145.6591	109.0680	87.3918	46.6745	21.3758	7.4919	2.8484	29.5533	50.6755	92.0011	124.7271	145.0029	(64)	
Efficiency of water heater	89.7543	89.7887	89.7979	89.7618	89.5574	87.2000	87.2000	87.2000	87.2000	89.2138	89.5818	89.7726	(217)	
Fuel for water heating, kWh/month	162.2866	121.4719	97.3205	51.9982	23.8683	8.5916	3.2665	33.8914	58.1141	103.1243	139.2326	161.5224	(219)	
Water heating fuel used												964.6883	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2200.7541	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													335.5173	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.55 * 908 * 1.00) =													-399.4559	(233)
Total delivered energy for all uses													3226.5039	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2200.7541	3.4800	76.5862 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	964.6883	3.4800	33.5712 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	335.5173	13.1900	44.2547 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-399.4559	13.1900	-52.6882 (252)
Total energy cost			238.2114 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8578 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.0343
SAP rating (Section 12)		88 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2200.7541	0.2160	475.3629 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	964.6883	0.2160	208.3727 (264)
Space and water heating			683.7356 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	335.5173	0.5190	174.1335 (268)
Energy saving/generation technologies			
PV Unit	-399.4559	0.5190	-207.3176 (269)
Total kg/year			715.4264 (272)
CO2 emissions per m2			9.9900 (273)
EI value			91.7809
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	35.8200 (1b)	x 2.3900 (2b)	= 85.6098 (1b) - (3b)
First floor	35.8200 (1c)	x 2.6100 (2c)	= 93.4902 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.6400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.1000 (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) = 0.1675 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4175 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3549 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	4.7000	4.6000	4.3000	4.3000	4.0000	4.0000	3.9000	4.0000	4.5000	4.4000	4.7000 (22)
Wind factor	1.2750	1.1750	1.1500	1.0750	1.0750	1.0000	1.0000	0.9750	1.0000	1.1250	1.1000	1.1750 (22a)
Adj infilt rate	0.4525	0.4170	0.4081	0.3815	0.3815	0.3549	0.3549	0.3460	0.3549	0.3992	0.3904	0.4170 (22b)
Effective ac	0.6024	0.5869	0.5833	0.5728	0.5728	0.5630	0.5630	0.5599	0.5630	0.5797	0.5762	0.5869 (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			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.6200	1.1450	12.1603		(27)
Ground Floor			35.8200	0.1200	4.2984	84.0000	3008.8800 (28a)
Brick and Block	32.9800	10.5900	22.3900	0.2400	5.3736	42.2200	945.3058 (29a)
Tile Hung	12.8200	2.1800	10.6400	0.2400	2.5536	42.2200	449.2208 (29a)
Pitched Roof	35.8200		35.8200	0.1000	3.5820	9.1000	325.9620 (30)
Total net area of external elements Aum(A, m ²)			117.4400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3329		(33)
Party Wall 1			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Party Wall 2			39.4300	0.0000	0.0000	110.0000	4337.3000 (32)
Ground Floor Stud			67.5900			9.0000	608.3100 (32c)
Internal Wall 2			72.8500			9.0000	655.6500 (32c)
Internal Floor 1			35.8200			18.0000	644.7600 (32d)
Internal Ceiling 1			35.8200			18.0000	644.7600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15957.4486 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							222.7450 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.5621 (36)
Total fabric heat loss						(33) + (36) =	37.8950 (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	35.6016	34.6897	34.4734	33.8524	33.8524	33.2732	33.2732	33.0894	33.2732	34.2618	34.0547	34.6897 (38)
Heat transfer coeff	73.4965	72.5847	72.3684	71.7474	71.7474	71.1682	71.1682	70.9844	71.1682	72.1567	71.9497	72.5847 (39)
Average = Sum(39)m / 12 =												71.9270 (39)
HLP	1.0259	1.0132	1.0102	1.0015	1.0015	0.9934	0.9934	0.9908	0.9934	1.0072	1.0043	1.0132 (40)
HLP (average)												1.0040 (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												2.2853 (42)
Average daily hot water use (litres/day)												88.4752 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.3227	93.7837	90.2447	86.7057	83.1667	79.6277	79.6277	83.1667	86.7057	90.2447	93.7837	97.3227 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	144.3268	126.2292	130.2572	113.5614	108.9648	94.0284	87.1311	99.9842	101.1783	117.9136	128.7119	139.7728 (45)
Distribution loss (46)m = 0.15 x (45)m	21.6490	18.9344	19.5386	17.0342	16.3447	14.1043	13.0697	14.9976	15.1768	17.6870	19.3068	20.9659 (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	25.2930	22.8224	25.2312	24.3760	25.1585	24.3123	25.1011	25.1383	24.3470	25.2011	24.4360	25.2811 (61)
Total heat required for water heating calculated for each month	169.6198	149.0516	155.4883	137.9373	134.1233	118.3406	112.2322	125.1225	125.5253	143.1147	153.1479	165.0539 (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												1234.4649 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2073.9010 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4898 (H8)
Utilisation factor												0.4889 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.4752 (H14)
Volume ratio Veff/V												0.8477 (H15)
Solar storage volume factor												0.9670 (H16)
Solar input												-862.1134 (H17)
Solar input	-28.2918	-40.3873	-68.4497	-93.4038	-110.2369	-117.3129	-112.9818	-100.7946	-79.7730	-54.6204	-33.2626	-22.5988 (63)
Solar input (sum of months) = Sum (63)m =												-862.1134 (63)
Output from w/h	141.3281	108.6642	87.0387	44.5335	23.8864	1.0278	0.0000	24.3279	45.7523	88.4943	119.8853	142.4551 (64)
Total per year (kWh/year) = Sum (64)m =												827.3936 (64)
Heat gains from water heating, kWh/month	54.3119	47.6768	49.6183	43.8531	42.5204	37.3425	35.2464	39.5293	39.7285	45.5065	48.9057	52.7947 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	137.1164	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.4959	42.1855	34.3075	25.9730	19.4151	16.3911	17.7111	23.0216	30.8995	39.2341	45.7919	48.8160	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.1404	303.2549	295.4064	278.6979	257.6064	237.7834	224.5404	221.4259	229.2744	245.9829	267.0744	286.8974	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	50.9969	(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)	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	-91.4109	(71)
Water heating gains (Table 5)	72.9999	70.9476	66.6913	60.9071	57.1511	51.8646	47.3742	53.1308	55.1785	61.1647	67.9246	70.9607	(72)
Total internal gains	520.3386	516.0903	496.1075	465.2804	433.8750	405.7414	389.3281	397.2807	415.0548	446.0840	480.4933	506.3764	(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					7.0000	13.8645	0.6300	0.7000			0.7700			29.6603 (74)
West					3.6200	25.9136	0.6300	0.7000			0.7700			28.6688 (80)
Solar gains	58.3291	96.9060	162.0911	253.3546	311.6175	353.4537	325.0846	273.5528	203.5065	122.0916	71.7975	46.0426 (83)		
Total gains	578.6676	612.9963	658.1986	718.6350	745.4925	759.1951	714.4126	670.8335	618.5613	568.1756	552.2908	552.4189 (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	60.3107	61.0683	61.2508	61.7810	61.7810	62.2838	62.2838	62.4450	62.2838	61.4305	61.6073	61.0683	
util living area	5.0207	5.0712	5.0834	5.1187	5.1187	5.1523	5.1523	5.1630	5.1523	5.0954	5.1072	5.0712	
	0.9837	0.9774	0.9543	0.8856	0.7368	0.5158	0.3672	0.3896	0.6550	0.8936	0.9673	0.9860	(86)
MIT	20.1508	20.2458	20.4639	20.7317	20.9210	20.9897	20.9986	20.9981	20.9677	20.7694	20.4499	20.1441	(87)
Th 2	20.0618	20.0724	20.0749	20.0821	20.0821	20.0888	20.0888	20.0910	20.0888	20.0773	20.0797	20.0724	(88)
util rest of house	0.9791	0.9710	0.9414	0.8550	0.6767	0.4359	0.2775	0.2949	0.5695	0.8561	0.9565	0.9819	(89)
MIT 2	19.3101	19.4117	19.6249	19.8786	20.0343	20.0848	20.0885	20.0906	20.0742	19.9136	19.6186	19.3124	(90)
Living area fraction									fLA = Living area / (4) =			0.1904	(91)
MIT	19.4702	19.5705	19.7847	20.0410	20.2031	20.2571	20.2618	20.2634	20.2443	20.0766	19.7769	19.4707	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.4702	19.5705	19.7847	20.0410	20.2031	20.2571	20.2618	20.2634	20.2443	20.0766	19.7769	19.4707	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9754	0.9668	0.9365	0.8534	0.6852	0.4510	0.2947	0.3130	0.5848	0.8560	0.9521	0.9785	(94)
Useful gains	564.4192	592.6286	616.4023	613.3085	510.7878	342.3749	210.5099	209.9910	361.7525	486.3828	525.8131	540.5681	(95)
Ext temp.	5.4000	5.7000	7.3000	9.6000	12.6000	15.4000	17.3000	17.3000	15.0000	11.8000	8.4000	5.5000	(96)
Heat loss rate W	1034.1091	1006.7861	903.4950	749.1153	545.5055	345.6693	210.7860	210.3536	373.2274	597.2103	818.5630	1014.0628	(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	349.4492	278.3139	213.5970	97.7810	25.8300	0.0000	0.0000	0.0000	0.0000	82.4557	210.7800	352.2801	(98)
Space heating												1610.4867	(98)
Space heating per m2												(98) / (4) =	22.4803 (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													1775.6193 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	349.4492	278.3139	213.5970	97.7810	25.8300	0.0000	0.0000	0.0000	0.0000	82.4557	210.7800	352.2801	(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)	385.2803	306.8510	235.4983	107.8070	28.4785	0.0000	0.0000	0.0000	0.0000	90.9103	232.3925	388.4014	(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	141.3281	108.6642	87.0387	44.5335	23.8864	1.0278	0.0000	24.3279	45.7523	88.4943	119.8853	142.4551	(64)
Efficiency of water heater	89.6636	89.6891	89.6581	89.5749	88.9840	87.2000	87.2000	87.2000	87.2000	88.8538	89.3990	89.6637	(217)
Fuel for water heating, kWh/month	157.6203	121.1565	97.0784	49.7165	26.8435	1.1786	0.0000	27.8990	52.4682	99.5954	134.1014	158.8770	(219)
Water heating fuel used												926.5348	(219)
Annual totals kWh/year													
Space heating fuel - main system												1775.6193	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													335.5173 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.55 * 1054 * 1.00) =										-463.9548		-463.9548	(233)
Total delivered energy for all uses												2698.7167	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1775.6193	10.2300	181.6459 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	926.5348	10.2300	94.7845 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	335.5173	36.7200	123.2020 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-463.9548	36.7200	-170.3642 (252)
Total energy cost			378.1681 (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	1775.6193	0.2160	383.5338 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	926.5348	0.2160	200.1315 (264)
Space and water heating			583.6653 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	335.5173	0.5190	174.1335 (268)
Energy saving/generation technologies			
PV Unit	-463.9548	0.5190	-240.7925 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Total kg/year

581.8812 (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	1775.6193	1.2200	2166.2556 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	926.5348	1.2200	1130.3725 (264)
Space and water heating			3296.6280 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	335.5173	3.0700	1030.0381 (268)
Energy saving/generation technologies			
PV Unit	-463.9548	3.0700	-1424.3412 (269)
Primary energy kWh/year			3286.0750 (272)
Primary energy kWh/m2/year			45.8693 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 52	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.61	TER	18.26
Environmental	90 B	% DER<TER	19.97		
CO ₂ Emissions (t/year)	0.77	DFEE	40.29	TFEE	47.96
General Requirements Compliance	Pass	% DFEE<TFEE	16.00		

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

Building Elements

Roof 000002 - Mineral Wool between and above

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	Mineral wool batt						
	Main construction	350	0.0380	9.2105	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Mineral wool batt						
	Main construction	100	0.0380	2.6316	87.50		
	Main construction	100	0.1300	0.7692	12.50		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.772 m² K/W Lower limit = 11.430 m² K/W Average = 11.601 m² K/W
Total correction = 0.0096 m² K/W U-value (unrounded) = 0.1 W/m² 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 0906 Plot 52	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.61	TER	18.26
Environmental	90 B	% DER<TER	19.97		
CO ₂ Emissions (t/year)	0.77	DFEE	40.29	TFEE	47.96
General Requirements Compliance	Pass	% DFEE<TFEE	16.00		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.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 0906 Plot 52	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.61	TER	18.26
Environmental	90 B	% DER<TER	19.97		
CO ₂ Emissions (t/year)	0.77	DFEE	40.29	TFEE	47.96
General Requirements Compliance	Pass	% DFEE<TFEE	16.00		

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

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

Building Elements

Wall Tile Hung

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				0.1300			
Layer 1	Tiling						
	Main construction	30	1.5000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	92.97		
	Main construction	100	0.8800	0.1136	7.03		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 5	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 6	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 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance:	Upper limit = 4.349 m ² K/W	Lower limit = 4.137 m ² K/W	Average = 4.243 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: 383 mm

U-value: 0.24 W/m² K

Kappa: 42.22 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 52	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.61	TER	18.26
Environmental	90 B	% DER<TER	19.97		
CO ₂ Emissions (t/year)	0.77	DFEE	40.29	TFEE	47.96
General Requirements Compliance	Pass	% DFEE<TFEE	16.00		

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

Building Elements

Floor 000003 - Worst Case Slab

Floor Type: Slab On Ground Floor

Area = 42.27 m², Perimeter = 18.36 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 Designed)

Property Reference	SAP 0906 Plot 52				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block J			
Property						
SAP Rating	87 B	DER	14.61	TER	18.26	
Environmental	90 B	% DER<TER	19.97			
CO ₂ Emissions (t/year)	0.77	DFEE	40.29	TFEE	47.96	
General Requirements Compliance	Pass	% DFEE<TFEE	16.00			
Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com			Assessor ID	E477-0001	
Client	Foreman Homes, FORE					

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

Orientation	West
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2022
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	9.16 m	35.82 m ²	2.39 m
	1st Storey:	9.16 m	35.82 m ²	2.61 m

7.0 Living Area	13.64	m ²
-----------------	-------	----------------

8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	222.74	kJ/m ² K

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	32.98	22.39	
Tile Hung	Cavity Wall	Other	0.24	42.22	12.82	10.64	

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 both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	39.43	
Party Wall 2	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	39.43	

9.2 Internal Walls					
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)	
Ground Floor Stud	Plasterboard on timber frame		9.00	67.59	
Internal Wall 2	Plasterboard on timber frame		9.00	72.85	

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	35.82	35.82

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	35.82

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	35.82

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.82

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	West							2.15	
Front Elevation	Window	[1] Brick and Block	West	None	0.00					1.44	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					7.00	
Front Tiled	Window	[2] Tile Hung	West	None	0.00					2.18	

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)	0.46	0.093	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.02	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	2.73	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.25	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.81	0.061	No	Birtley Supatherm
Independently assessed	E3 Sill	6.25	0.021	No	Knauf P5
Independently assessed	E4 Jamb	22.20	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	9.16	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	9.16	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	9.16	0.071	No	Knauf P16
Independently assessed	E18 Party wall between dwellings	10.00	0.036	No	Knauf P25 Halved
Independently assessed	E25 Staggered party wall between dwellings	10.00	0.055	No	Knauf P27 Halved
Table K1 - Default	P1 Party wall - Ground floor	17.66	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	17.66	0.000	No	
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	17.66	0.035	No	Knauf P29 Halved
Y-value	0.064	W/m²K			

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present	No
---------------------------------------	---------------------------------

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				3
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	15	
Total number of L.E.L. fittings	15	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff	Standard
--------------------------------	---------------------------------------

24.0 Main Heating 1

	Database	
Description	Mains Gas Combi	
Percentage of Heat	100	%
Database Ref. No.	17513	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.7	
In Summer	87.2	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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			
	Orientation	Elevation	Overshading	Connected to Dwelling
	PV Cells kWp			
0.55	East	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	£82	B 88	