



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project:

Contact: Tobias Whiting
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Report Issue Date: 29/11/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

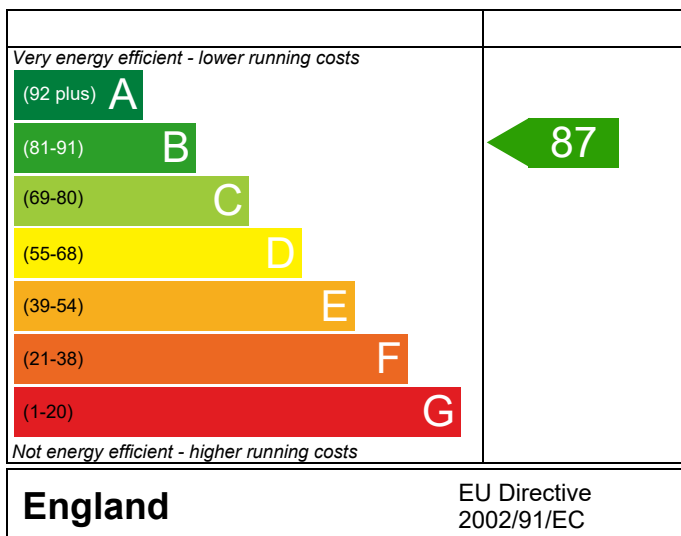
PREDICTED ENERGY ASSESSMENT

Dwelling type: House, End-Terrace
Date of assessment: 29/11/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 84.54 m²
DRRN: 7942-0921-7223

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.

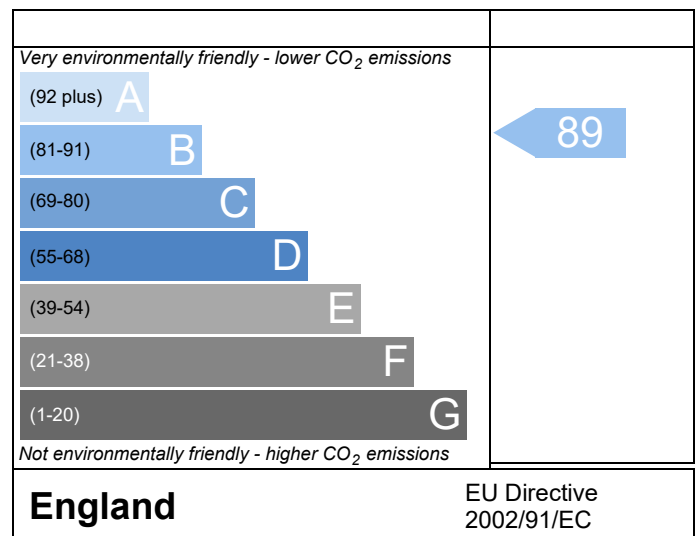
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

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 50				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C			
Property						
SAP Rating	87 B	DER	14.58	TER	18.28	
Environmental	89 B	% DER<TER	20.24			
CO ₂ Emissions (t/year)	0.91	DFEE	44.28	TFEE	52.46	
General Requirements Compliance	Pass	% DFEE<TFEE	15.60			
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)	18.28	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.58	kgCO ₂ /m ²	Pass
	-3.70 (-20.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	52.46	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.28	kWh/m ² /yr	
	-8.2 (-15.6%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	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

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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

1.44 m², No overhang

Windows facing East

3.62 m², No overhang

Windows facing West

7.82 m², No overhang

Air change rate

4.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

m³/(h.m²) @ 50 Pa

Maximum

10.0

m³/(h.m²) @ 50 Pa

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Door U-value

1.10

W/m²K

Photovoltaic array

0.70

kW

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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	£85	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£85	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 50	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Property			

SAP Rating	87 B	DER	14.58	TER	18.28
Environmental	89 B	% DER<TER	20.24		
CO ₂ Emissions (t/year)	0.91	DFEE	44.28	TFEE	52.46
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

Assessor Details	Mr. Tobias Whiting, Abacus Energy (UK) Ltd, Tel: 07798936079, toby@abacusenergyuk.com	Assessor ID	E477-0001
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Client	Foreman Homes, FORE
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	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	0.077	1.37	0.11	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.071	3.75	0.27	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.064	3.74	0.24	Birtley Supatherm
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.067	1.59	0.11	Birtley Supatherm
External wall	E3 Sill	Independently assessed	0.021	8.30	0.17	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	28.80	0.46	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	18.73	3.00	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	18.73	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	13.91	0.99	Knauf P16
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	4.82	0.21	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	14.99	0.58	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	5.00	0.18	Knauf P25 Halved
External wall	E25 Staggered party wall between dwellings	Independently assessed	0.055	5.00	0.28	Knauf P27 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.47	1.36	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	8.47	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	8.47	0.30	Knauf P29 Halved

Total: **8.28** W/mK:
Y-Value: **0.046** W/m²K:

FULL SAP CALCULATION PRINTOUT

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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

End-Terrace House, total floor area 85 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) 18.28 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.58 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)52.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)44.3 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	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 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: 1.44 m², No overhang
Windows facing East: 3.62 m², No overhang
Windows facing West: 7.82 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Door U-value 1.10 W/m²K
Photovoltaic array 0.70 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	94.7294	94.4850	94.2456	93.1207	92.9102	91.9305	91.9305	91.7490	92.3079	92.9102	93.3360	93.7811 (39)
Average = Sum(39)m / 12 =												93.1197 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1176	1.1148	1.1015	1.0990	1.0874	1.0874	1.0853	1.0919	1.0990	1.1040	1.1093 (40)
HLP (average)												1.1015 (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
Average daily hot water use (litres/day)
2.5434 (42)
94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	391.7754	389.5607	375.4667	352.7818	329.7301	307.6063	293.3118	299.4970	311.2294	334.1304	360.3941	380.1025	(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			1.4400			10.6334	0.6300		0.7000		0.7700	4.6796 (74)		
East			3.6200			19.6403	0.6300		0.7000		0.7700	21.7284 (76)		
West			7.8200			19.6403	0.6300		0.7000		0.7700	46.9381 (80)		
Solar gains	73.3461	143.2692	236.4125	347.0398	428.2773	439.9585	418.2103	357.0802	275.5545	170.0349	91.3920	60.3691 (83)		
Total gains	465.1215	532.8299	611.8792	699.8216	758.0074	747.5648	711.5221	656.5772	586.7839	504.1652	451.7861	440.4716 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.6127	43.7255	43.8366	44.3661	44.4666	44.9405	44.9405	45.0294	44.7568	44.4666	44.2638	44.0537
alpha	3.9075	3.9150	3.9224	3.9577	3.9644	3.9960	3.9960	4.0020	3.9838	3.9644	3.9509	3.9369
util living area	0.9941	0.9892	0.9759	0.9365	0.8472	0.6948	0.5412	0.5988	0.8307	0.9622	0.9899	0.9952 (86)
MIT	19.3643	19.5467	19.8744	20.3082	20.6742	20.8984	20.9714	20.9574	20.7801	20.2934	19.7530	19.3342 (87)
Th 2	19.9841	19.9865	19.9888	19.9996	20.0016	20.0111	20.0111	20.0129	20.0075	20.0016	19.9975	19.9932 (88)
util rest of house	0.9926	0.9866	0.9697	0.9193	0.8055	0.6151	0.4312	0.4881	0.7690	0.9488	0.9869	0.9941 (89)
MIT 2	18.4880	18.6711	18.9970	19.4269	19.7656	19.9558	20.0012	19.9967	19.8691	19.4214	18.8858	18.4650 (90)
Living area fraction	18.6766	18.8595	19.1858	19.6165	19.9611	20.1586	20.2099	20.2034	20.0651	19.6090	19.0724	18.6520 (91)
MIT	18.6766	18.8595	19.1858	19.6165	19.9611	20.1586	20.2099	20.2034	20.0651	19.6090	19.0724	18.6520 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6766	18.8595	19.1858	19.6165	19.9611	20.1586	20.2099	20.2034	20.0651	19.6090	19.0724	18.6520 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9901	0.9827	0.9634	0.9114	0.8035	0.6280	0.4543	0.5108	0.7732	0.9420	0.9832	0.9919	(94)
Useful gains	460.4956	523.5871	589.4634	637.8232	609.0777	469.4335	323.2672	335.3518	453.6802	474.9364	444.1828	436.8971	(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	1361.8842	1318.9605	1195.5801	997.9295	767.5367	511.0036	331.8629	348.9570	550.6289	837.0282	1117.4587	1355.3269	(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	670.6332	534.4909	450.9508	259.2766	117.8935	0.0000	0.0000	0.0000	0.0000	269.3963	484.7587	683.3118	(98)
Space heating												3470.7117	(98)
Space heating per m2											(98) / (4) =	41.0541	(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													3826.5840	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	670.6332	534.4909	450.9508	259.2766	117.8935	0.0000	0.0000	0.0000	0.0000	269.3963	484.7587	683.3118	(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)	739.3971	589.2954	497.1895	285.8617	129.9818	0.0000	0.0000	0.0000	0.0000	297.0191	534.4638	753.3757	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)	
Efficiency of water heater (217)m	89.9373	89.8775	89.7370	89.4081	88.7554	87.2000	87.2000	87.2000	87.2000	89.4092	89.7967	87.2000	(216)	
Fuel for water heating, kWh/month	199.7449	175.6190	183.3790	163.1214	159.6615	143.2162	135.6606	151.4705	152.0293	169.2507	180.5315	194.2575	(219)	
Water heating fuel used												2007.9420	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3826.5840	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.70 * 908 * 1.00) =													-508.3984	(233)
Total delivered energy for all uses													5780.4713	(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	3826.5840	0.2160	826.5422	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2007.9420	0.2160	433.7155	(264)
Space and water heating			1260.2576	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	379.3436	0.5190	196.8793	(268)
Energy saving/generation technologies				
PV Unit	-508.3984	0.5190	-263.8588	(269)
Total CO2, kg/year			1232.2032	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.5800	(273)

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

DER		14.5800	ZC1
Total Floor Area		84.5400	
Assumed number of occupants		2.5434	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.0283	ZC2
CO2 emissions from cooking, equation (L16)		2.1297	ZC3
Total CO2 emissions		32.7380	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		32.7380	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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 211.3500 (5)
Dwelling volume			

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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.8800	1.3258	17.0758		(27)
Ground Floor			42.2700	0.1300	5.4951		(28a)
Brick and Block	75.5000	12.8500	62.6500	0.1800	11.2770		(29a)
Tile Hung	18.1500	2.1800	15.9700	0.1800	2.8746		(29a)
Pitched Roof	42.2700		42.2700	0.1300	5.4951		(30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.3676	(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)							10.1642 (36)
Total fabric heat loss						(33) + (36) =	54.5318 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	95.6966	95.4523	95.2128	94.0879	93.8774	92.8977	92.8977	92.7163	93.2751	93.8774	94.3032	94.7483 (39)
Average = Sum(39)m / 12 =												94.0869 (39)
HLP	1.1320	1.1291	1.1262	1.1129	1.1104	1.0989	1.0989	1.0967	1.1033	1.1104	1.1155	1.1208 (40)
HLP (average)												1.1129 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy content (annual)	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Distribution loss (46)m = 0.15 x (45)m	23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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	(57)
Combi loss	50.9589	46.0274	49.1740	45.7216	45.3173	41.9892	43.3889	45.3173	45.7216	49.1740	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161	(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	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161	(64)
Heat gains from water heating, kWh/month	64.0534	56.3861	58.6049	51.8058	50.0704	43.9279	41.8256	46.8775	47.4031	54.2162	58.0907	62.4342	(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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	86.0932	83.9079	78.7700	71.9524	67.2990	61.0110	56.2172	63.0074	65.8377	72.8713	80.6815	83.9170	(72)
Total internal gains	400.3911	398.1769	383.4967	360.1803	336.4921	313.7340	299.4478	306.2668	318.6394	342.1719	369.0169	388.7225	(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	1.4400				10.6334		0.6300		0.7000		0.7700		4.6796 (74)	
East	3.6200				19.6403		0.6300		0.7000		0.7700		21.7284 (76)	
West	7.8200				19.6403		0.6300		0.7000		0.7700		46.9381 (80)	
Solar gains	73.3461	143.2692	236.4125	347.0398	428.2773	439.9585	418.2103	357.0802	275.5545	170.0349	91.3920	60.3691	(83)	
Total gains	473.7372	541.4462	619.9092	707.2200	764.7694	753.6926	717.6581	663.3470	594.1938	512.2068	460.4089	449.0916	(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	61.3484	61.5054	61.6602	62.3973	62.5372	63.1968	63.1968	63.3204	62.9411	62.5372	62.2549	61.9624		
alpha	5.0899	5.1004	5.1107	5.1598	5.1691	5.2131	5.2131	5.2214	5.1961	5.1691	5.1503	5.1308		
util living area	0.9986	0.9968	0.9907	0.9657	0.8879	0.7261	0.5561	0.6185	0.8701	0.9827	0.9970	0.9989	(86)	
MIT	19.7460	19.8881	20.1449	20.4905	20.7829	20.9470	20.9892	20.9818	20.8582	20.4708	20.0478	19.7232	(87)	
Th 2	19.9748	19.9772	19.9795	19.9903	19.9923	20.0018	20.0018	20.0035	19.9981	19.9923	19.9882	19.9839	(88)	
util rest of house	0.9981	0.9957	0.9873	0.9524	0.8452	0.6368	0.4369	0.4966	0.8047	0.9738	0.9958	0.9985	(89)	
MIT 2	18.2979	18.5072	18.8823	19.3843	19.7759	19.9659	19.9977	19.9958	19.8799	19.3647	18.7488	18.2711	(90)	
Living area fraction	18.6095	18.8043	19.1540	19.6223	19.9926	20.1770	20.2110	20.2080	20.0904	19.6027	19.0283	18.5836	(92)	
Temperature adjustment	18.6095	18.8043	19.1540	19.6223	19.9926	20.1770	20.2110	20.2080	20.0904	19.6027	19.0283	18.5836	(93)	
adjusted MIT	18.6095	18.8043	19.1540	19.6223	19.9926	20.1770	20.2110	20.2080	20.0904	19.6027	19.0283	18.5836	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9970	0.9939	0.9834	0.9461	0.8453	0.6537	0.4627	0.5228	0.8118	0.9690	0.9940	0.9977	(94)
Ext temp.	472.3394	538.1214	609.6495	669.1263	646.4272	492.6620	332.0361	346.8026	482.3433	496.3254	457.6662	448.0786	(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	1369.3725	1327.1958	1204.8208	1008.8384	778.4861	518.0860	335.4566	353.0610	558.7567	845.1495	1124.8788	1362.8195	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	667.3927	530.2580	442.8074	244.5927	98.2518	0.0000	0.0000	0.0000	0.0000	259.5252	480.3931	680.5672	(98)
Space heating per m2												3403.7880	(98)
												40.2625	(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													3644.3126 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	667.3927	530.2580	442.8074	244.5927	98.2518	0.0000	0.0000	0.0000	0.0000	259.5252	480.3931	680.5672	(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)	714.5532	567.7280	474.0979	261.8765	105.1947	0.0000	0.0000	0.0000	0.0000	277.8642	514.3395	728.6587	(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	205.2856	181.0025	188.4563	167.1512	161.8319	142.5325	136.5570	152.2290	153.9102	175.2575	186.9450	200.4161	(64)
Efficiency of water heater (217)m	87.8021	87.5962	87.1284	86.0083	83.8385	80.3000	80.3000	80.3000	80.3000	86.0379	87.3232	87.8853	(216)
Fuel for water heating, kWh/month	233.8048	206.6328	216.2973	194.3430	193.0280	177.5000	170.0585	189.5754	191.6690	203.6981	214.0840	228.0428	(219)
Water heating fuel used												2418.7338	(219)
Annual totals kWh/year													
Space heating fuel - main system												3644.3126	(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)												379.3436	(232)
Total delivered energy for all uses												6517.3900	(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	3644.3126	0.2160	787.1715 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2418.7338	0.2160	522.4465 (264)
Space and water heating			1309.6180 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Total CO2, kg/m2/year			1545.4224 (272)
Emissions per m2 for space and water heating			15.4911 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3288 (272b)
Emissions per m2 for pumps and fans			0.4604 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.4911 * 1.00) + 2.3288 + 0.4604, rounded to 2 d.p.			18.2800 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			9.0000	380.4300 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14492.6234 (34)
171.4292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	94.7294	94.4850	94.2456	93.1207	92.9102	91.9305	91.9305	91.7490	92.3079	92.9102	93.3360	93.7811 (39)
Average = Sum(39)m / 12 =												93.1197 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1176	1.1148	1.1015	1.0990	1.0874	1.0874	1.0853	1.0919	1.0990	1.1040	1.1093 (40)
HLP (average)												1.1015 (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
Average daily hot water use (litres/day)
2.5434 (42)
94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1488.5106 (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	32.7944	28.6822	29.5975	25.8038	24.7594	21.3654	19.7982	22.7188	22.9901	26.7927	29.2464	31.7596 (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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	44.0785	42.6819	39.7816	35.8386	33.2787	29.6742	26.6105	30.5360	31.9307	36.0117	40.6199	42.6877	(72)
Total internal gains	355.3764	353.9509	341.5083	321.0664	299.4718	279.3972	266.8411	270.7954	281.7324	302.3124	325.9553	344.4932	(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			1.4400		10.6334		0.6300		0.7000		0.7700		4.6796 (74)
East			3.6200		19.6403		0.6300		0.7000		0.7700		21.7284 (76)
West			7.8200		19.6403		0.6300		0.7000		0.7700		46.9381 (80)
Solar gains	73.3461	143.2692	236.4125	347.0398	428.2773	439.9585	418.2103	357.0802	275.5545	170.0349	91.3920	60.3691	(83)
Total gains	428.7225	497.2202	577.9208	668.1062	727.7491	719.3558	685.0514	627.8756	557.2868	472.3472	417.3472	404.8623	(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	42.4972	42.6070	42.7153	43.2313	43.3292	43.7910	43.7910	43.8776	43.6120	43.3292	43.1316	42.9269	
alpha	3.8331	3.8405	3.8477	3.8821	3.8886	3.9194	3.9194	3.9252	3.9075	3.8886	3.8754	3.8618	
util living area	0.9951	0.9908	0.9786	0.9420	0.8575	0.7100	0.5573	0.6182	0.8457	0.9674	0.9916	0.9961	(86)
MIT	19.2799	19.4676	19.8058	20.2560	20.6408	20.8835	20.9659	20.9491	20.7517	20.2377	19.6793	19.2500	(87)
Th 2	19.9841	19.9865	19.9888	19.9996	20.0016	20.0111	20.0111	20.0129	20.0075	20.0016	19.9975	19.9932	(88)
util rest of house	0.9939	0.9885	0.9731	0.9262	0.8179	0.6315	0.4459	0.5067	0.7875	0.9558	0.9892	0.9951	(89)
MIT 2	18.4065	18.5950	18.9319	19.3792	19.7381	19.9463	19.9989	19.9929	19.8479	19.3700	18.8152	18.3836	(90)
Living area fraction	18.5945	18.7828	19.1200	19.5679	19.9323	20.1480	20.2070	20.1986	20.0423	19.5567	19.0011	18.5700	(91)
MIT	18.5945	18.7828	19.1200	19.5679	19.9323	20.1480	20.2070	20.1986	20.0423	19.5567	19.0011	18.5700	(92)
Temperature adjustment	18.5945	18.7828	19.1200	19.5679	19.9323	20.1480	20.2070	20.1986	20.0423	19.5567	19.0011	18.5700	(93)
adjusted MIT	18.5945	18.7828	19.1200	19.5679	19.9323	20.1480	20.2070	20.1986	20.0423	19.5567	19.0011	18.5700	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	425.1419	489.7104	558.8581	613.3015	592.9259	462.7632	321.3461	332.2396	440.1849	448.2548	411.4321	402.1301	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1354.1045	1311.7155	1189.3764	993.3990	764.8678	510.0270	331.5920	348.5196	548.5243	832.1669	1110.8009	1347.6350	(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	691.1482	552.3875	469.1056	273.6702	127.9248	0.0000	0.0000	0.0000	0.0000	285.6307	503.5456	703.4557	(98)
Space heating												3606.8681	(98)
Space heating per m2												42.6646	(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	864.1465	680.2855	697.2928	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	0.8274	0.8893	0.8597	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	715.0289	604.9727	599.4477	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	936.5021	894.4521	829.3893	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	159.4607	215.3727	171.0765	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												545.9099 (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	39.8652	53.8432	42.7691	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												136.4775 (107)
Space cooling per m2												1.6144 (108)
Energy for space heating												42.6646 (99)
Energy for space cooling												1.6144 (108)
Total												44.2790 (109)
Dwelling Fabric Energy Efficiency (DFEE)												44.3 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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) =	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.8800	1.3258	17.0758		(27)
Ground Floor			42.2700	0.1300	5.4951		(28a)
Brick and Block	75.5000	12.8500	62.6500	0.1800	11.2770		(29a)
Tile Hung	18.1500	2.1800	15.9700	0.1800	2.8746		(29a)
Pitched Roof	42.2700		42.2700	0.1300	5.4951		(30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	44.3676	(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)							10.1642 (36)
Total fabric heat loss						(33) + (36) =	54.5318 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	95.6966	95.4523	95.2128	94.0879	93.8774	92.8977	92.8977	92.7163	93.2751	93.8774	94.3032	94.7483 (39)
Average = Sum(39)m / 12 =												94.0869 (39)
HLP	1.1320	1.1291	1.1262	1.1129	1.1104	1.0989	1.0989	1.0967	1.1033	1.1104	1.1155	1.1208 (40)
HLP (average)												1.1129 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy content (annual)	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)
Distribution loss (46)m = 0.15 x (45)m												1488.5106 (45)
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

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	(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	32.7944	28.6822	29.5975	25.8038	24.7594	21.3654	19.7982	22.7188	22.9901	26.7927	29.2464	(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	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	127.1692	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.4800	19.0784	15.5156	11.7463	8.7805	7.4129	8.0098	10.4115	13.9743	17.7436	20.7094	22.0770	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	228.6671	231.0400	225.0605	212.3308	196.2619	181.1594	171.0700	168.6972	174.6767	187.4063	203.4752	218.5777	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	35.7169	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	44.0785	42.6819	39.7816	35.8386	33.2787	29.6742	26.6105	30.5360	31.9307	36.0117	40.6199	42.6877	(72)
Total internal gains	355.3764	353.9509	341.5083	321.0664	299.4718	279.3972	266.8411	270.7954	281.7324	302.3124	325.9553	344.4932	(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				1.4400	10.6334		0.6300	0.7000		0.7700		4.6796 (74)	
East				3.6200	19.6403		0.6300	0.7000		0.7700		21.7284 (76)	
West				7.8200	19.6403		0.6300	0.7000		0.7700		46.9381 (80)	
Solar gains	73.3461	143.2692	236.4125	347.0398	428.2773	439.9585	418.2103	357.0802	275.5545	170.0349	91.3920	60.3691 (83)	
Total gains	428.7225	497.2202	577.9208	668.1062	727.7491	719.3558	685.0514	627.8756	557.2868	472.3472	417.3472	404.8623 (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	61.3484	61.5054	61.6602	62.3973	62.5372	63.1968	63.1968	63.3204	62.9411	62.5372	62.2549	61.9624		
alpha	5.0899	5.1004	5.1107	5.1598	5.1691	5.2131	5.2131	5.2214	5.1961	5.1691	5.1503	5.1308		
util living area	0.9991	0.9979	0.9932	0.9726	0.9037	0.7500	0.5797	0.6475	0.8925	0.9878	0.9981	0.9993	(86)	
MIT	19.6962	19.8395	20.1000	20.4534	20.7590	20.9383	20.9869	20.9776	20.8362	20.4296	20.0003	19.6741	(87)	
Th 2	19.9748	19.9772	19.9795	19.9903	19.9923	20.0018	20.0018	20.0035	19.9981	19.9923	19.9882	19.9839	(88)	
util rest of house	0.9988	0.9971	0.9906	0.9615	0.8648	0.6615	0.4569	0.5227	0.8332	0.9812	0.9973	0.9991	(89)	
MIT 2	18.7802	18.9252	19.1863	19.5417	19.8254	19.9726	19.9984	19.9969	19.9019	19.5243	19.0948	18.7654	(90)	
Living area fraction	18.9773	19.1219	19.3829	19.7379	20.0263	20.1804	20.2111	20.2079	20.1029	19.7191	19.2896	18.9609	(92)	
MIT	18.9773	19.1219	19.3829	19.7379	20.0263	20.1804	20.2111	20.2079	20.1029	19.7191	19.2896	18.9609	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9773	19.1219	19.3829	19.7379	20.0263	20.1804	20.2111	20.2079	20.1029	19.7191	19.2896	18.9609	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	428.0127	495.3380	571.3257	640.0340	630.4442	488.2119	331.2701	345.1879	468.4450	462.2996	415.9044	404.3648	(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	1404.5654	1357.5119	1226.6138	1019.7108	781.6519	518.4057	335.4596	353.0541	559.9255	856.0745	1149.5200	1398.5743	(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	726.5553	579.3809	487.5344	273.3673	112.4985	0.0000	0.0000	0.0000	0.0000	292.9685	528.2032	739.6919	(98)
Space heating												3740.1999	(98)
Space heating per m2												44.2418	(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	873.2382	687.4429	704.6435	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8669	0.9271	0.8992	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	757.0070	637.3438	633.6358	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	936.5021	894.4521	829.3893	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	129.2365	191.2886	145.6406	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												466.1657 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	32.3091	47.8221	36.4102	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												116.5414 (107)
Space cooling per m2												1.3785 (108)
Energy for space heating												44.2418 (99)
Energy for space cooling												1.3785 (108)
Total												45.6203 (109)
Target Fabric Energy Efficiency (TFEE)												52.5 (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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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) =		0.3332 (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	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	0.5766 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7294	93.7811	93.5561	92.9102	92.9102	92.3079	92.3079	92.1168	92.3079	93.3360	93.1207	93.7811 (39)
Average = Sum(39)m / 12 =												93.0971 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1093	1.1066	1.0990	1.0990	1.0919	1.0919	1.0896	1.0919	1.1040	1.1015	1.1093 (40)
HLP (average)												1.1012 (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
Average daily hot water use (litres/day)
2.5434 (42)
94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum (45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(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	(63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037 (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)												
	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353 (71)
Water heating gains (Table 5)												
	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970 (72)
Total internal gains												
	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962 (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	1.4400				13.8645		0.6300		0.7000		0.7700		6.1015 (74)	
East	3.6200				25.9136		0.6300		0.7000		0.7700		28.6688 (76)	
West	7.8200				25.9136		0.6300		0.7000		0.7700		61.9309 (80)	
Solar gains	96.7012	161.4224	264.3006	393.3457	462.1702	513.1626	476.3740	416.4448	326.0909	202.4938	119.4080	75.9822	(83)	
Total gains	675.8442	735.9170	816.4119	910.8484	944.2579	963.6366	908.4795	857.1693	786.8372	698.0648	653.6059	639.3785	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.6127	44.0537	44.1596	44.4666	44.4666	44.7568	44.7568	44.8496	44.7568	44.2638	44.3661	44.0537
alpha	3.9075	3.9369	3.9440	3.9644	3.9644	3.9838	3.9838	3.9900	3.9838	3.9509	3.9577	3.9369
util living area	0.9739	0.9635	0.9313	0.8539	0.7164	0.5147	0.3711	0.3915	0.6416	0.8713	0.9537	0.9775 (86)
MIT	19.8027	19.9368	20.2358	20.5868	20.8473	20.9691	20.9936	20.9923	20.9279	20.6326	20.1929	19.7862 (87)
Th 2	19.9841	19.9932	19.9954	20.0016	20.0016	20.0075	20.0075	20.0093	20.0075	19.9975	19.9996	19.9932 (88)
util rest of house	0.9678	0.9551	0.9155	0.8215	0.6573	0.4317	0.2739	0.2897	0.5561	0.8329	0.9410	0.9721 (89)
MIT 2	18.9213	19.0593	19.3500	19.6813	19.9032	19.9938	20.0059	20.0074	19.9712	19.7281	19.3170	18.9127 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	19.1110	19.2481	19.5406	19.8761	20.1063	20.2037	20.2184	20.2193	20.1771	19.9227	19.5055	19.1007 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1110	19.2481	19.5406	19.8761	20.1063	20.2037	20.2184	20.2193	20.1771	19.9227	19.5055	19.1007 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9611	0.9474	0.9070	0.8169	0.6639	0.4486	0.2949	0.3116	0.5717	0.8296	0.9333	0.9660	(94)
Useful gains	649.5322	697.2327	740.4541	744.0856	626.9088	432.3153	267.8952	267.1048	449.8052	579.0810	609.9936	617.6281	(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	1298.8299	1270.5575	1145.1804	954.7556	697.4126	443.4149	269.3931	268.9191	477.8833	758.1393	1034.1495	1275.4839	(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	483.0775	385.2743	301.1163	151.6824	52.4548	0.0000	0.0000	0.0000	0.0000	133.2194	305.3922	489.4447	(98)
Space heating												2301.6616	(98)
RHI space heating demand												2302	(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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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)	=	0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Heat transfer coeff	94.7294	94.4850	94.2456	93.1207	92.9102	91.9305	91.9305	91.7490	92.3079	92.9102	93.3360	93.7811 (39)
Average = Sum(39)m / 12 =												93.1197 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1176	1.1148	1.1015	1.0990	1.0874	1.0874	1.0853	1.0919	1.0990	1.1040	1.1093 (40)
HLP (average)												1.1015 (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
Average daily hot water use (litres/day)
2.5434 (42)
94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(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					1.4400	10.6334		0.6300	0.7000		0.7700	4.6796 (74)
East					3.6200	19.6403		0.6300	0.7000		0.7700	21.7284 (76)
West					7.8200	19.6403		0.6300	0.7000		0.7700	46.9381 (80)
Solar gains	73.3461	143.2692	236.4125	347.0398	428.2773	439.9585	418.2103	357.0802	275.5545	170.0349	91.3920	60.3691 (83)
Total gains	652.4892	717.7639	788.5238	864.5425	910.3650	890.4324	850.3158	797.8047	736.3007	665.6058	625.5899	623.7654 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.6127	43.7255	43.8366	44.3661	44.4666	44.9405	44.9405	45.0294	44.7568	44.4666	44.2638	44.0537
alpha	3.9075	3.9150	3.9224	3.9577	3.9644	3.9960	3.9960	4.0020	3.9838	3.9644	3.9509	3.9369
util living area	0.9813	0.9714	0.9476	0.8884	0.7772	0.6118	0.4626	0.5087	0.7377	0.9158	0.9702	0.9841 (86)
MIT	19.6243	19.7954	20.0939	20.4736	20.7701	20.9358	20.9836	20.9761	20.8621	20.4761	19.9873	19.5913 (87)
Th 2	19.9841	19.9865	19.9888	19.9996	20.0016	20.0111	20.0111	20.0129	20.0075	20.0016	19.9975	19.9932 (88)
util rest of house	0.9771	0.9650	0.9355	0.8627	0.7276	0.5332	0.3644	0.4082	0.6658	0.8906	0.9624	0.9805 (89)
MIT 2	18.7449	18.9151	19.2082	19.5773	19.8417	19.9777	20.0057	20.0043	19.9264	19.5894	19.1149	18.7195 (90)
Living area fraction	18.9341	19.1045	19.3988	19.7701	20.0415	20.1839	20.2161	20.2134	20.1277	19.7802	19.3026	18.9071 (91)
MIT	18.9341	19.1045	19.3988	19.7701	20.0415	20.1839	20.2161	20.2134	20.1277	19.7802	19.3026	18.9071 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9341	19.1045	19.3988	19.7701	20.0415	20.1839	20.2161	20.2134	20.1277	19.7802	19.3026	18.9071 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9714	0.9579	0.9270	0.8559	0.7298	0.5476	0.3853	0.4293	0.6753	0.8839	0.9555	0.9754 (94)
Useful gains	633.8536	687.5644	730.9710	739.9754	664.3895	487.6230	327.6366	342.5005	497.2241	588.3576	597.7233	608.4338 (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	1386.2818	1342.1135	1215.6501	1012.2338	775.0108	513.3280	332.4277	349.8740	556.4071	852.9347	1138.9433	1379.2471 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	559.8066	439.8570	360.6012	196.0260	82.3022	0.0000	0.0000	0.0000	0.0000	196.8454	389.6784	573.4851 (98)
Space heating												2798.6018 (98)
Space heating per m2												33.1039 (99)
												(98) / (4) =

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													3085.5588 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	559.8066	439.8570	360.6012	196.0260	82.3022	0.0000	0.0000	0.0000	0.0000	196.8454	389.6784	573.4851	(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)	617.2068	484.9581	397.5758	216.1257	90.7411	0.0000	0.0000	0.0000	0.0000	217.0291	429.6343	632.2879	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Efficiency of water heater (217)m	89.8241	89.7487	89.5734	89.1731	88.4541	87.2000	87.2000	87.2000	87.2000	89.1449	89.6429	89.8576	(216)
Fuel for water heating, kWh/month	199.9967	175.8712	183.7140	163.5512	160.2053	143.2162	135.6606	151.4705	152.0293	169.7526	180.8413	194.4887	(219)
Water heating fuel used												2010.7975	(219)
Annual totals kWh/year													
Space heating fuel - main system													3085.5588 (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)													379.3436 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.70 * 908 * 1.00) =										-508.3984			-508.3984 (233)
Total delivered energy for all uses													5042.3016 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3085.5588	3.4800	107.3774 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2010.7975	3.4800	69.9758 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	379.3436	13.1900	50.0354 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-508.3984	13.1900	-67.0577 (252)
Total energy cost			290.2234 (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] =	0.9410 (257)
SAP value		86.8734
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	3085.5588	0.2160	666.4807 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2010.7975	0.2160	434.3323 (264)
Space and water heating			1100.8130 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Energy saving/generation technologies			
PV Unit	-508.3984	0.5190	-263.8588 (269)
Total kg/year			1072.7586 (272)
CO2 emissions per m2			12.6900 (273)
EI value			88.9031
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

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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	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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) =		0.3332 (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	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	0.5766 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7294	93.7811	93.5561	92.9102	92.9102	92.3079	92.3079	92.1168	92.3079	93.3360	93.1207	93.7811 (39)
Average = Sum(39)m / 12 =												93.0971 (39)
HLP	1.1205	1.1093	1.1066	1.0990	1.0990	1.0919	1.0919	1.0896	1.0919	1.1040	1.1015	1.1093 (40)
HLP (average)												1.1012 (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												2.5434 (42)
Average daily hot water use (litres/day)												94.6054 (43)
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m = 1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186	(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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)
Total heat required for water heating calculated for each month												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(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	(63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Heat gains from water heating, kWh/month												
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209	(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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4400	13.8645	0.6300	0.7000	0.7700	6.1015	(74)
East	3.6200	25.9136	0.6300	0.7000	0.7700	28.6688	(76)
West	7.8200	25.9136	0.6300	0.7000	0.7700	61.9309	(80)

Solar gains	96.7012	161.4224	264.3006	393.3457	462.1702	513.1626	476.3740	416.4448	326.0909	202.4938	119.4080	75.9822	(83)
Total gains	675.8442	735.9170	816.4119	910.8484	944.2579	963.6366	908.4795	857.1693	786.8372	698.0648	653.6059	639.3785	(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	43.6127	44.0537	44.1596	44.4666	44.4666	44.7568	44.7568	44.8496	44.7568	44.2638	44.3661	44.0537
alpha	3.9075	3.9369	3.9440	3.9644	3.9644	3.9838	3.9838	3.9900	3.9838	3.9509	3.9577	3.9369
util living area	0.9739	0.9635	0.9313	0.8539	0.7164	0.5147	0.3711	0.3915	0.6416	0.8713	0.9537	0.9775 (86)
MIT	19.8027	19.9368	20.2358	20.5868	20.8473	20.9691	20.9936	20.9923	20.9279	20.6326	20.1929	19.7862 (87)
Th 2	19.9841	19.9932	19.9954	20.0016	20.0016	20.0075	20.0075	20.0093	20.0075	19.9975	19.9996	19.9932 (88)
util rest of house	0.9678	0.9551	0.9155	0.8215	0.6573	0.4317	0.2739	0.2897	0.5561	0.8329	0.9410	0.9721 (89)
MIT 2	18.9213	19.0593	19.3500	19.6813	19.9032	19.9938	20.0059	20.0074	19.9712	19.7281	19.3170	18.9127 (90)
Living area fraction	19.1110	19.2481	19.5406	19.8761	20.1063	20.2037	20.2184	20.2193	20.1771	19.9227	19.5055	19.1007 (92)
MIT	19.1110	19.2481	19.5406	19.8761	20.1063	20.2037	20.2184	20.2193	20.1771	19.9227	19.5055	19.1007 (93)
Temperature adjustment												0.0000
adjusted MIT	19.1110	19.2481	19.5406	19.8761	20.1063	20.2037	20.2184	20.2193	20.1771	19.9227	19.5055	19.1007 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	649.5322	697.2327	740.4541	744.0856	626.9088	432.3153	267.8952	267.1048	449.8052	579.0810	609.9936	617.6281	(94)
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	1298.8299	1270.5575	1145.1804	954.7556	697.4126	443.4149	269.3931	268.9191	477.8833	758.1393	1034.1495	1275.4839	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	483.0775	385.2743	301.1163	151.6824	52.4548	0.0000	0.0000	0.0000	0.0000	133.2194	305.3922	489.4447	(98)
Space heating												2301.6616	(98)
Space heating per m2												27.2257	(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													2537.6644 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	483.0775	385.2743	301.1163	151.6824	52.4548	0.0000	0.0000	0.0000	0.0000	133.2194	305.3922	489.4447	(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)	532.6102	424.7787	331.9915	167.2353	57.8333	0.0000	0.0000	0.0000	0.0000	146.8791	336.7059	539.6303	(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	179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629	(64)
Efficiency of water heater (217)m	89.7238	89.6542	89.4315	88.9499	88.1186	87.2000	87.2000	87.2000	87.2000	88.8044	89.4550	87.2000	(216)
Fuel for water heating, kWh/month	200.2203	176.0566	184.0055	163.9616	160.8152	143.2162	135.6606	151.4705	152.0293	170.4034	181.2212	194.7173	(219)
Water heating fuel used												2013.7775	(219)
Annual totals kWh/year													
Space heating fuel - main system												2537.6644	(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)												379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.70 * 1054 * 1.00) =										-590.4879		-590.4879	(233)
Total delivered energy for all uses												4415.2977	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2537.6644	10.2300	259.6031 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2013.7775	10.2300	206.0094 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	379.3436	36.7200	139.2950 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-590.4879	36.7200	-216.8272 (252)
Total energy cost			518.6203 (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	2537.6644	0.2160	548.1355 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2013.7775	0.2160	434.9759 (264)
Space and water heating			983.1115 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Energy saving/generation technologies			
PV Unit	-590.4879	0.5190	-306.4632 (269)
Total kg/year			912.4526 (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	2537.6644	1.2200	3095.9506 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2013.7775	1.2200	2456.8086 (264)
Space and water heating			5552.7591 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	379.3436	3.0700	1164.5850 (268)
Energy saving/generation technologies			
PV Unit	-590.4879	3.0700	-1812.7979 (269)
Primary energy kWh/year			5134.7962 (272)
Primary energy kWh/m2/year			60.7381 (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 89

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 85	-193 kg (21.1%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£85	2.28 kg/m²	B 88	B 91
Total Savings	£85	2.28 kg/m²		
Potential energy efficiency rating:			B 88	
Potential environmental impact rating:				B 91

Fuel prices for cost data on this page from database revision number 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	£167	£185	-£18
Mains gas	£569	£465	£104
Space heating	£390	£390	£0
Water heating	£206	£121	£85
Lighting	£139	£139	£0
Generated (PV)	-£217	-£217	£0
Total cost of fuels	£519	£433	£86
Total cost of uses	£518	£433	£85
Delivered energy	52 kWh/m²	41 kWh/m²	11 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	48 kWh/m²	13 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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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) = 0.3332 (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	0.4248	0.4164	0.4081	0.3665	0.3581	0.3165	0.3165	0.3082	0.3332	0.3581	0.3748	0.3915 (22b)
Effective ac	0.5902	0.5867	0.5833	0.5671	0.5641	0.5501	0.5501	0.5475	0.5555	0.5641	0.5702	0.5766 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)												
175.9292 (35)												
8.2833 (36)												
(33) + (36) = 53.5646 (37)												

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.1648	40.9205	40.6810	39.5561	39.3457	38.3659	38.3659	38.1845	38.7433	39.3457	39.7714	40.2165 (38)
Average = Sum(39)m / 12 =	94.7294	94.4850	94.2456	93.1207	92.9102	91.9305	91.9305	91.7490	92.3079	92.9102	93.3360	93.7811 (39)
	93.1197											93.1197 (39)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												
Average daily hot water use (litres/day)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m													
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)	
Total heat required for water heating calculated for each month													
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (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												1.2184 (H8)	
Utilisation factor												0.5599 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												94.6054 (H14)	
Volume ratio Veff/V												0.7928 (H15)	
Solar storage volume factor												0.9536 (H16)	
Solar input												-851.3931 (H17)	
Solar input	-24.6887	-41.1983	-70.1655	-94.0356	-116.1731	-114.2166	-112.7072	-98.4729	-77.1240	-52.6666	-29.2844	-20.6602 (63)	
												Solar input (sum of months) = Sum(63)m =	-851.3931 (63)
Output from w/h													
154.9565	116.6437	94.3934	51.8081	25.5351	10.6679	5.5888	33.6094	55.4456	98.6591	132.8270	154.1027 (64)		
												Total per year (kWh/year) = Sum(64)m =	934.2373 (64)
Heat gains from water heating, kWh/month													
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209 (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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				1.4400	10.6334	0.6300		0.7000	0.7700		4.6796 (74)		
East				3.6200	19.6403	0.6300		0.7000	0.7700		21.7284 (76)		
West				7.8200	19.6403	0.6300		0.7000	0.7700		46.9381 (80)		
Solar gains	73.3461	143.2692	236.4125	347.0398	428.2773	439.9585	418.2103	357.0802	275.5545	170.0349	91.3920	60.3691 (83)	
Total gains	652.4892	717.7639	788.5238	864.5425	910.3650	890.4324	850.3158	797.8047	736.3007	665.6058	625.5899	623.7654 (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	43.6127	43.7255	43.8366	44.3661	44.4666	44.9405	44.9405	45.0294	44.7568	44.4666	44.2638	44.0537
alpha	3.9075	3.9150	3.9224	3.9577	3.9644	3.9960	3.9960	4.0020	3.9838	3.9644	3.9509	3.9369
util living area	0.9813	0.9714	0.9476	0.8884	0.7772	0.6118	0.4626	0.5087	0.7377	0.9158	0.9702	0.9841 (86)
MIT	19.6243	19.7954	20.0939	20.4736	20.7701	20.9358	20.9836	20.9761	20.8621	20.4761	19.9873	19.5913 (87)
Th 2	19.9841	19.9865	19.9888	19.9996	20.0016	20.0111	20.0111	20.0129	20.0075	20.0016	19.9975	19.9932 (88)
util rest of house	0.9771	0.9650	0.9355	0.8627	0.7276	0.5332	0.3644	0.4082	0.6658	0.8906	0.9624	0.9805 (89)
MIT 2	18.7449	18.9151	19.2082	19.5773	19.8417	19.9777	20.0057	20.0043	19.9264	19.5894	19.1149	18.7195 (90)
Living area fraction												0.2152 (91)
MIT	18.9341	19.1045	19.3988	19.7701	20.0415	20.1839	20.2161	20.2134	20.1277	19.7802	19.3026	18.9071 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9341	19.1045	19.3988	19.7701	20.0415	20.1839	20.2161	20.2134	20.1277	19.7802	19.3026	18.9071 (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	0.9714	0.9579	0.9270	0.8559	0.7298	0.5476	0.3853	0.4293	0.6753	0.8839	0.9555	0.9754	(94)
Useful gains	633.8536	687.5644	730.9710	739.9754	664.3895	487.6230	327.6366	342.5005	497.2241	588.3576	597.7233	608.4338	(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	1386.2818	1342.1135	1215.6501	1012.2338	775.0108	513.3280	332.4277	349.8740	556.4071	852.9347	1138.9433	1379.2471	(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	559.8066	439.8570	360.6012	196.0260	82.3022	0.0000	0.0000	0.0000	0.0000	196.8454	389.6784	573.4851	(98)
Space heating												2798.6018	(98)
Space heating per m2												(98) / (4) =	33.1039 (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													3085.5588 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	559.8066	439.8570	360.6012	196.0260	82.3022	0.0000	0.0000	0.0000	0.0000	196.8454	389.6784	573.4851	(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)	617.2068	484.9581	397.5758	216.1257	90.7411	0.0000	0.0000	0.0000	0.0000	217.0291	429.6343	632.2879	(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	154.9565	116.6437	94.3934	51.8081	25.5351	10.6679	5.5888	33.6094	55.4456	98.6591	132.8270	154.1027	(64)
Efficiency of water heater	89.9176	89.9433	89.9510	89.9453	89.8461	87.2000	87.2000	87.2000	87.2000	89.5006	89.7839	89.9354	(217)
Fuel for water heating, kWh/month	172.3317	129.6858	104.9387	57.5995	28.4209	12.2338	6.4092	38.5429	63.5844	110.2328	147.9408	171.3481	(219)
Water heating fuel used												1043.2687	(219)
Annual totals kWh/year													
Space heating fuel - main system												3085.5588	(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)													379.3436 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.70 * 908 * 1.00) =										-508.3984		-508.3984	(233)
Total delivered energy for all uses												4124.7728	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3085.5588	3.4800	107.3774 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1043.2687	3.4800	36.3058 (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	379.3436	13.1900	50.0354 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-508.3984	13.1900	-67.0577 (252)
Total energy cost			263.1484 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8532 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.0980
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	3085.5588	0.2160	666.4807 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1043.2687	0.2160	225.3460 (264)
Space and water heating			891.8267 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	379.3436	0.5190	196.8793 (268)
Energy saving/generation technologies			
PV Unit	-508.3984	0.5190	-263.8588 (269)
Total kg/year			889.7223 (272)
CO2 emissions per m2			10.5200 (273)
EI value			90.7964
EI rating			91 (274)
EI band			B

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	42.2700 (1b)	x 2.3900 (2b)	= 101.0253 (1b) - (3b)
First floor	42.2700 (1c)	x 2.6100 (2c)	= 110.3247 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 211.3500 (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) = 0.1419 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3919 (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) =		0.3332 (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	0.4248	0.3915	0.3831	0.3581	0.3581	0.3332	0.3332	0.3248	0.3332	0.3748	0.3665	0.3915 (22b)
Effective ac	0.5902	0.5766	0.5734	0.5641	0.5641	0.5555	0.5555	0.5528	0.5555	0.5702	0.5671	0.5766 (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)			12.8800	1.1450	14.7481		(27)
Ground Floor			42.2700	0.1200	5.0724	84.0000	3550.6800 (28a)
Brick and Block	75.5000	12.8500	62.6500	0.2400	15.0360	42.2200	2645.0830 (29a)
Tile Hung	18.1500	2.1800	15.9700	0.2400	3.8328	42.2200	674.2534 (29a)
Pitched Roof	42.2700		42.2700	0.1000	4.2270	9.1000	384.6570 (30)
Total net area of external elements Aum(A, m ²)			178.1900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		45.2813		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			69.2600			9.0000	623.3400 (32c)
First Floor Stud			90.7800			9.0000	817.0200 (32c)
Internal Floor 1			42.2700			18.0000	760.8600 (32d)
Internal Ceiling 1			42.2700			18.0000	760.8600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14873.0534 (34)
175.9292 (35)
8.2833 (36)
(33) + (36) = 53.5646 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.1648	40.2165	39.9916	39.3457	39.3457	38.7433	38.7433	38.5522	38.7433	39.7714	39.5561	40.2165 (38)
Heat transfer coeff	94.7294	93.7811	93.5561	92.9102	92.9102	92.3079	92.3079	92.1168	92.3079	93.3360	93.1207	93.7811 (39)
Average = Sum(39)m / 12 =												93.0971 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1205	1.1093	1.1066	1.0990	1.0990	1.0919	1.0919	1.0896	1.0919	1.1040	1.1015	1.1093 (40)
HLP (average)												1.1012 (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
Average daily hot water use (litres/day)
2.5434 (42)
94.6054 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.0659	100.2817	96.4975	92.7132	88.9290	85.1448	85.1448	88.9290	92.7132	96.4975	100.2817	104.0659 (44)
Energy conte	154.3267	134.9751	139.2822	121.4296	116.5146	100.5433	93.1681	106.9118	108.1886	126.0834	137.6299	149.4572 (45)

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)												Total = Sum(45)m =	1488.5106 (45)
Distribution loss (46)m = 0.15 x (45)m													
23.1490	20.2463	20.8923	18.2144	17.4772	15.0815	13.9752	16.0368	16.2283	18.9125	20.6445	22.4186 (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	25.3185	22.8670	25.2767	24.4141	25.1935	24.3412	25.1280	25.1705	24.3809	25.2423	24.4815	25.3057 (61)	
Total heat required for water heating calculated for each month													
179.6452	157.8421	164.5589	145.8437	141.7081	124.8845	118.2961	132.0822	132.5696	151.3257	162.1114	174.7629 (62)		
Aperture area of solar collector													
Zero-loss collector efficiency													
Collector heat loss coefficient													
Collector 2nd order heat loss coefficient													
Collector effective heat loss coefficient													
Collector performance ratio													
Annual solar radiation per m2													
Overshading factor													
Solar energy available													
Adjustment factor for showers													
Solar-to-load ratio													
Utilisation factor													
Collector performance factor													
Dedicated solar storage volume													
Effective solar volume													
Daily hot water demand													
Volume ratio Veff/V													
Solar storage volume factor													
Solar input													
Solar input	-29.2250	-41.7196	-70.7076	-96.4849	-113.8733	-121.1827	-116.7087	-104.1196	-82.4045	-56.4222	-34.3598	-890.5523 (H17)	
Output from w/h													
150.4202	116.1225	93.8513	49.3588	27.8348	3.7018	1.5873	27.9627	50.1650	94.9035	127.7515	151.4187 (64)		
Heat gains from water heating, kWh/month													
57.6433	50.5960	52.6305	46.4789	45.0395	39.5159	37.2604	41.8408	42.0680	48.2333	51.8823	56.0209 (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	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	152.6030	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.7000	47.6959	38.7889	29.3657	21.9512	18.5321	20.0246	26.0288	34.9357	44.3589	51.7734	55.1925	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	341.2942	344.8358	335.9112	316.9117	292.9282	270.3872	255.3284	251.7868	260.7114	279.7109	303.6944	326.2354	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	52.8037	(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)	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	-101.7353	(71)
Water heating gains (Table 5)	77.4775	75.2916	70.7399	64.5540	60.5370	54.8833	50.0812	56.2376	58.4277	64.8297	72.0588	75.2970	(72)
Total internal gains	579.1431	574.4946	552.1113	517.5027	482.0877	450.4739	432.1055	440.7245	460.7462	495.5709	534.1979	563.3962	(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	1.4400	13.8645	0.6300	0.7000	0.7700	6.1015 (74)
East	3.6200	25.9136	0.6300	0.7000	0.7700	28.6688 (76)
West	7.8200	25.9136	0.6300	0.7000	0.7700	61.9309 (80)

Solar gains	96.7012	161.4224	264.3006	393.3457	462.1702	513.1626	476.3740	416.4448	326.0909	202.4938	119.4080	75.9822	(83)
Total gains	675.8442	735.9170	816.4119	910.8484	944.2579	963.6366	908.4795	857.1693	786.8372	698.0648	653.6059	639.3785	(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	43.6127	44.0537	44.1596	44.4666	44.4666	44.7568	44.7568	44.8496	44.7568	44.2638	44.3661	44.0537
alpha	3.9075	3.9369	3.9440	3.9644	3.9644	3.9838	3.9838	3.9900	3.9838	3.9509	3.9577	3.9369
util living area	0.9739	0.9635	0.9313	0.8539	0.7164	0.5147	0.3711	0.3915	0.6416	0.8713	0.9537	0.9775 (86)
MIT	19.8027	19.9368	20.2358	20.5868	20.8473	20.9691	20.9936	20.9923	20.9279	20.6326	20.1929	19.7862 (87)
Th 2	19.9841	19.9932	19.9954	20.0016	20.0016	20.0075	20.0075	20.0093	20.0075	19.9975	19.9996	19.9932 (88)
util rest of house	0.9678	0.9551	0.9155	0.8215	0.6573	0.4317	0.2739	0.2897	0.5561	0.8329	0.9410	0.9721 (89)
MIT 2	18.9213	19.0593	19.3500	19.6813	19.9032	19.9938	20.0059	20.0074	19.9712	19.7281	19.3170	18.9127 (90)
Living area fraction												
MIT	19.1110	19.2481	19.5406	19.8761	20.1063	20.2037	20.2184	20.2193	20.1771	19.9227	19.5055	19.1007 (92)
Temperature adjustment												
adjusted MIT	19.1110	19.2481	19.5406	19.8761	20.1063	20.2037	20.2184	20.2193	20.1771	19.9227	19.5055	19.1007 (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	0.9611	0.9474	0.9070	0.8169	0.6639	0.4486	0.2949	0.3116	0.5717	0.8296	0.9333	0.9660	(94)
Useful gains	649.5322	697.2327	740.4541	744.0856	626.9088	432.3153	267.8952	267.1048	449.8052	579.0810	609.9936	617.6281	(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	1298.8299	1270.5575	1145.1804	954.7556	697.4126	443.4149	269.3931	268.9191	477.8833	758.1393	1034.1495	1275.4839	(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	483.0775	385.2743	301.1163	151.6824	52.4548	0.0000	0.0000	0.0000	0.0000	133.2194	305.3922	489.4447	(98)
Space heating												2301.6616	(98)
Space heating per m2											(98) / (4) =	27.2257	(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													2537.6644	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	483.0775	385.2743	301.1163	151.6824	52.4548	0.0000	0.0000	0.0000	0.0000	133.2194	305.3922	489.4447	(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)	532.6102	424.7787	331.9915	167.2353	57.8333	0.0000	0.0000	0.0000	0.0000	146.8791	336.7059	539.6303	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	150.4202	116.1225	93.8513	49.3588	27.8348	3.7018	1.5873	27.9627	50.1650	94.9035	127.7515	151.4187	(64)	
Efficiency of water heater	89.8438	89.8438	89.8431	89.8149	89.4552	87.2000	87.2000	87.2000	87.2000	89.2104	89.6388	89.8479	(217)	
Fuel for water heating, kWh/month	167.4242	129.2193	104.4613	54.9561	31.1159	4.2452	1.8203	32.0673	57.5287	106.3817	142.5181	168.5277	(219)	
Water heating fuel used												1000.2658	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2537.6644	(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)													379.3436	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.70 * 1054 * 1.00) =										-590.4879			-590.4879	(233)
Total delivered energy for all uses													3451.7859	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2537.6644	10.2300	259.6031	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1000.2658	10.2300	102.3272	(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	379.3436	36.7200	139.2950	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-590.4879	36.7200	-216.8272	(252)
Total energy cost			433.2981	(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	2537.6644	0.2160	548.1355	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1000.2658	0.2160	216.0574	(264)
Space and water heating			764.1929	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	379.3436	0.5190	196.8793	(268)
Energy saving/generation technologies				
PV Unit	-590.4879	0.5190	-306.4632	(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 719.4840 (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	2537.6644	1.2200	3095.9506 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1000.2658	1.2200	1220.3243 (264)
Space and water heating			4316.2748 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	379.3436	3.0700	1164.5850 (268)
Energy saving/generation technologies			
PV Unit	-590.4879	3.0700	-1812.7979 (269)
Primary energy kWh/year			4051.8119 (272)
Primary energy kWh/m2/year			47.9277 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 50	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.58	TER	18.28
Environmental	89 B	% DER<TER	20.24		
CO ₂ Emissions (t/year)	0.91	DFEE	44.28	TFEE	52.46
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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 50	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.58	TER	18.28
Environmental	89 B	% DER<TER	20.24		
CO ₂ Emissions (t/year)	0.91	DFEE	44.28	TFEE	52.46
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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

Wall 000001

Wall Type: Standard Wall

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

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

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

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 50	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.58	TER	18.28
Environmental	89 B	% DER<TER	20.24		
CO ₂ Emissions (t/year)	0.91	DFEE	44.28	TFEE	52.46
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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

Wall 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 50	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	14.58	TER	18.28
Environmental	89 B	% DER<TER	20.24		
CO ₂ Emissions (t/year)	0.91	DFEE	44.28	TFEE	52.46
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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 50	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block C
Property			

SAP Rating	87 B	DER	14.58	TER	18.28
Environmental	89 B	% DER<TER	20.24		
CO ₂ Emissions (t/year)	0.91	DFEE	44.28	TFEE	52.46
General Requirements Compliance	Pass	% DFEE<TFEE	15.60		

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	East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, End-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:	18.73 m	42.27 m ²	2.39 m
	1st Storey:	18.73 m	42.27 m ²	2.61 m

7.0 Living Area	18.19	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	175.93	kJ/m ² K

9.0 External Walls				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction					
Brick and Block	Cavity Wall	Other		0.24	42.22	75.50	62.65
Tile Hung	Cavity Wall	Other		0.24	42.22	18.15	15.97

9.1 Party Walls				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Description	Type	Construction				
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	42.33

9.2 Internal Walls				Kappa (kJ/m ² K)	Area (m ²)
Description	Construction				
Ground Floor Stud	Plasterboard on timber frame			9.00	69.26
First Floor Stud	Plasterboard on timber frame			9.00	90.78

10.0 External Roofs				U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Description	Type	Construction					
Pitched Roof	External Plane Roof	Other		0.10	9.10	42.27	42.27

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	42.27

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	42.27

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	42.27

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Front Door	Manufacturer	Solid Door							1.10
Windows	Manufacturer	Window	Double Low-E Soft 0.1			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	East							2.15	
Front Elevation	Window	[1] Brick and Block	East	None	0.00					1.44	
Side Elevation	Window	[1] Brick and Block	North	None	0.00					1.44	
Rear Elevation	Window	[1] Brick and Block	West	None	0.00					7.82	
Front Tiled	Window	[2] Tile Hung	East	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)	1.37	0.077	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.75	0.071	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	3.74	0.064	No	Birtley Supatherm
Independently assessed	E2 Other lintels (including other steel lintels)	1.59	0.067	No	Birtley Supatherm
Independently assessed	E3 Sill	8.30	0.021	No	Knauf P5
Independently assessed	E4 Jamb	28.80	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	18.73	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	18.73	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	13.91	0.071	No	Knauf P16
Independently assessed	E12 Gable (insulation at ceiling level)	4.82	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	14.99	0.039	No	Knauf P23
Independently assessed	E18 Party wall between dwellings	5.00	0.036	No	Knauf P25 Halved
Independently assessed	E25 Staggered party wall between dwellings	5.00	0.055	No	Knauf P27 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.47	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	8.47	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.47	0.035	No	Knauf P29 Halved

Y-value 0.046 W/m²K

18.0 Pressure Testing

Yes

Designed AP₅₀ 5.00

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Tested ?		m ³ /(h.m ²) @ 50 Pa
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	17	
Total number of L.E.L. fittings	17	
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	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Combi keep hot type	Gas/Oil, time clock			
25.0 Main Heating 2	None			
Community Heating	None			
28.0 Water Heating	HWP From main heating 1			
Water Heating	Main Heating 1			
Flue Gas Heat Recovery System	No			
Waste Water Heat Recovery Instantaneous System 1	No			
Waste Water Heat Recovery Instantaneous System 2	No			
Waste Water Heat Recovery Storage System	No			
Solar Panel	No			
Water use <= 125 litres/person/day	Yes			
SAP Code	901			
29.0 Hot Water Cylinder	None			
32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
0.70	West	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	£85	B 88	