



SAP Report Submission for Building Regulations Compliance

Client: Foreman Homes

Project:

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

Report Issue Date: 29/11/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

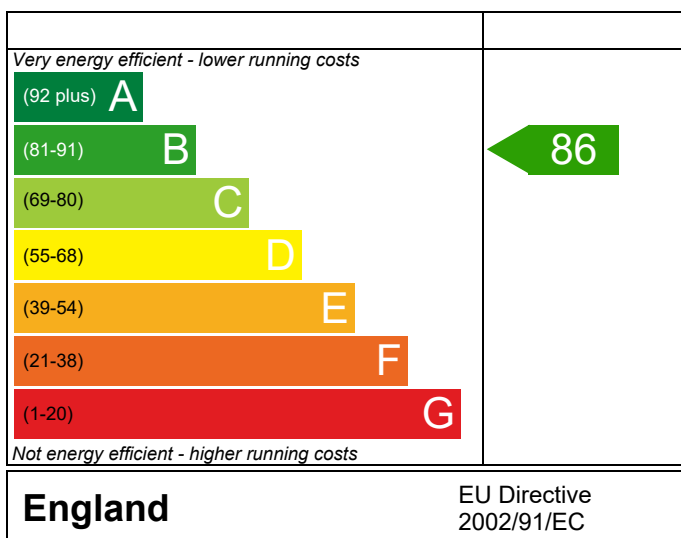
PREDICTED ENERGY ASSESSMENT

Dwelling type: House, Mid-Terrace
Date of assessment: 29/11/2023
Produced by: Abacus Energy (UK) Ltd
Total floor area: 71.86 m²
DRRN: 3227-1798-1955

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.

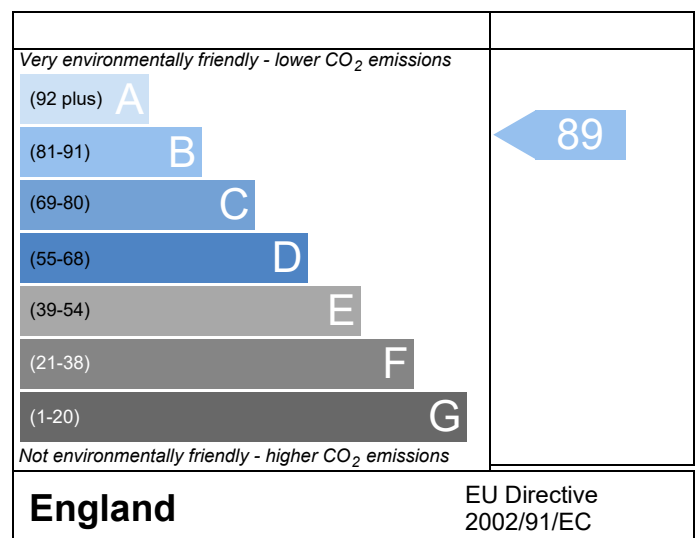
The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

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 26				Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Bv			
Property						
SAP Rating	86 B	DER	15.55	TER	19.53	
Environmental	89 B	% DER<TER	20.36			
CO ₂ Emissions (t/year)	0.83	DFEE	46.32	TFEE	54.65	
General Requirements Compliance	Pass	% DFEE<TFEE	15.23			
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)	19.53	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.55	kgCO ₂ /m ²	Pass
	-3.98 (-20.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	54.65	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.32	kWh/m ² /yr	
	-8.3 (-15.2%)	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)	0.26 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	m ³ /(h.m ²) @ 50 Pa	
Maximum	10.0	m ³ /(h.m ²) @ 50 Pa	Pass

Limiting System Efficiencies

4 Heating efficiency

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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

7.82 m², No overhang

Windows facing South

3.14 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

0.55

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	£82	B 88	B 91	Recommended
Photovoltaic			0	0	Already installed
Wind turbine			0	0	Not applicable
Totals	£4,000 - £6,000	£82	B 88	B 91	

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THERMAL BRIDGING

Calculation Type: New Build (As Designed)

Property Reference	SAP 0906 Plot 26	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Bv
Property			

SAP Rating	86 B	DER	15.55	TER	19.53
Environmental	89 B	% DER<TER	20.36		
CO ₂ Emissions (t/year)	0.83	DFEE	46.32	TFEE	54.65
General Requirements Compliance	Pass	% DFEE<TFEE	15.23		

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	0.071	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	6.47	0.14	Knauf P5
External wall	E4 Jamb	Independently assessed	0.016	22.50	0.36	Knauf P6
External wall	E5 Ground floor (normal)	Table K1 - Approved	0.160	16.95	2.71	
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.000	8.58	0.00	CD0029
External wall	E10 Eaves (insulation at ceiling level)	Independently assessed	0.071	8.58	0.61	Knauf P16
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.044	8.50	0.37	Knauf P21
External wall	E16 Corner (normal)	Independently assessed	0.039	0.90	0.04	Knauf P23
External wall	E18 Party wall between dwellings	Independently assessed	0.036	10.00	0.36	Knauf P25 Halved
Party wall	P1 Party wall - Ground floor	Table K1 - Default	0.160	8.50	1.36	
Party wall	P6 Party wall - Ground floor (inverted)	Table K1 - Default	0.070	8.50	0.60	
Party wall	P2 Party wall - Intermediate floor within a dwelling	Table K1 - Default	0.000	17.00	0.00	
Party wall	P4 Party wall - Roof (insulation at ceiling level)	Independently assessed	0.035	17.00	0.60	Knauf P29 Halved

Total: **7.75** W/mK:
Y-Value: **0.049** W/m²K:

FULL SAP CALCULATION PRINTOUT

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Client	Foreman Homes, FORE				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Mid-Terrace House, total floor area 72 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.53 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.55 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 46.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Worcester Greenstar 32CDi Compact ErP
Combi boiler
Efficiency: 89.8% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 7.82 m², No overhang
Windows facing South: 3.14 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 0.55 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4431	0.4342	0.3899	0.3810	0.3367	0.3367	0.3279	0.3544	0.3810	0.3987	0.4165 (22b)
Effective ac	0.6021	0.5981	0.5943	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.9300	0.1200	4.3116	84.0000	3018.1200 (28a)
Brick and Block	69.7200	10.9300	58.7900	0.2400	14.1096	42.2200	2482.1138 (29a)
Tile Hung	12.1400	2.1800	9.9600	0.2400	2.3904	42.2200	420.5112 (29a)
Cold Party Wall	3.8100		3.8100	0.2600	0.9906	113.5000	432.4350 (29a)
Pitched Roof	35.9300		35.9300	0.1000	3.5930	9.1000	326.9630 (30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.3098		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			58.9100			9.0000	530.1900 (32c)
First Floor Stud			60.4000			9.0000	543.6000 (32c)
Internal Floor 1			35.9300			18.0000	646.7400 (32d)
Internal Ceiling 1			35.9300			18.0000	646.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13703.7130 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.7002 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7483 (36)
Total fabric heat loss						(33) + (36) =	48.0581 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6960	35.4609	35.2305	34.1482	33.9457	33.0031	33.0031	32.8285	33.3662	33.9457	34.3554	34.7836 (38)
Heat transfer coeff	83.7541	83.5190	83.2886	82.2063	82.0038	81.0612	81.0612	80.8867	81.4243	82.0038	82.4135	82.8417 (39)
Average = Sum(39)m / 12 =												82.2054 (39)
HLP	1.1655	1.1622	1.1590	1.1440	1.1412	1.1280	1.1280	1.1256	1.1331	1.1412	1.1469	1.1528 (40)
HLP (average)												1.1440 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Energy content (annual)										Total =	Sum (45)m =	1393.9836 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.6789	18.9605	19.5656	17.0577	16.3673	14.1237	13.0877	15.0184	15.1977	17.7115	19.3335	20.9949 (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	25.2941	22.8233	25.2320	24.3767	25.1591	24.3128	25.1016	25.1389	24.3476	25.2019	24.4369	25.2821 (61)
Total heat required for water heating calculated for each month												
Solar input	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (64)
								Total per year (kWh/year) =	Sum (64)m =			1690.6906 (64)
Heat gains from water heating, kWh/month												
	54.3785	47.7350	49.6784	43.9055	42.5707	37.3858	35.2865	39.5754	39.7752	45.5609	48.9651	52.8592 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	18.9331	16.8162	13.6758	10.3535	7.7394	6.5339	7.0601	9.1770	12.3173	15.6397	18.2538	19.4593 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	201.5987	203.6906	198.4189	187.1962	173.0294	159.7147	150.8196	148.7276	153.9993	165.2221	179.3888	192.7036 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168 (71)
Water heating gains (Table 5)												
	73.0894	71.0343	66.7720	60.9799	57.2186	51.9248	47.4281	53.1928	55.2433	61.2378	68.0071	71.0473 (72)
Total internal gains	353.9774	351.8974	339.2231	318.8858	298.3437	278.5297	265.6641	271.4537	281.9163	302.4559	326.0060	343.5665 (73)

6. Solar gains

[Jan]												Gains					
			Area			Solar flux			g			FF			Access	factor	Gains
			m2			Table 6a			Specific data			Specific data			factor	Table 6d	W
						W/m2			or Table 6b			or Table 6c					
North			7.8200			10.6334			0.6300			0.7000			0.7700		25.4127
South			3.1400			46.7521			0.6300			0.7000			0.7700		44.8644
Solar gains	70.2771	122.0413	176.1196	238.3379	288.7958	297.2410	282.1200	242.2519	196.9922	137.0614	84.5295			59.9523	(83)		
Total gains	424.2545	473.9387	515.3427	557.2237	587.1395	575.7706	547.7842	513.7056	478.9085	439.5173	410.5355			403.5188	(84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.4496	45.5775	45.7036	46.3053	46.4196	46.9594	46.9594	47.0608	46.7500	46.4196	46.1889	45.9501
alpha	4.0300	4.0385	4.0469	4.0870	4.0946	4.1306	4.1306	4.1374	4.1167	4.0946	4.0793	4.0633
util living area	0.9943	0.9903	0.9815	0.9565	0.8929	0.7610	0.6077	0.6593	0.8630	0.9668	0.9902	0.9954 (86)
MIT	19.4341	19.5959	19.8733	20.2563	20.6158	20.8697	20.9616	20.9460	20.7602	20.3103	19.8104	19.4084 (87)
Th 2	19.9477	19.9503	19.9529	19.9651	19.9674	19.9780	19.9780	19.9800	19.9739	19.9674	19.9627	19.9579 (88)
util rest of house	0.9928	0.9978	0.9762	0.9430	0.8569	0.6805	0.4852	0.5395	0.8040	0.9538	0.9871	0.9941 (89)
MIT 2	18.5221	18.6849	18.9618	19.3463	19.6855	19.9066	19.9650	19.9598	19.8234	19.4050	18.9087	18.5043 (90)
Living area fraction									fLA = Living area / (4) =			0.2217 (91)
MIT	18.7242	18.8869	19.1639	19.5480	19.8918	20.1201	20.1859	20.1785	20.0310	19.6056	19.1086	18.7047 (92)
Temperature adjustment												0.0000
adjusted MIT	18.7242	18.8869	19.1639	19.5480	19.8918	20.1201	20.1859	20.1785	20.0310	19.6056	19.1086	18.7047 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9904	0.9843	0.9710	0.9362	0.8538	0.6929	0.5117	0.5647	0.8079	0.9479	0.9837	0.9921 (94)
Useful gains	420.1761	466.4890	500.4180	521.6779	501.2838	398.9670	280.3195	290.1077	386.9152	416.6364	403.8243	400.3251 (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	1208.0893	1168.1681	1054.7559	875.3369	671.7554	447.4682	290.6790	305.6269	482.9312	738.4978	989.6684	1201.5948 (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	586.2074	471.5284	412.4274	254.6344	126.8309	0.0000	0.0000	0.0000	0.0000	239.4649	421.8077	596.1446 (98)
Space heating												3109.0457 (98)
Space heating per m2										(98) / (4) =		43.2653 (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													3427.8343	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	586.2074	471.5284	412.4274	254.6344	126.8309	0.0000	0.0000	0.0000	0.0000	239.4649	421.8077	596.1446	(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)	646.3147	519.8770	454.7160	280.7436	139.8356	0.0000	0.0000	0.0000	0.0000	264.0186	465.0581	657.2708	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481	(64)	
Efficiency of water heater (217)m	89.8896	89.8332	89.7133	89.4377	88.8657	87.2000	87.2000	87.2000	87.2000	89.3574	89.7397	89.9167	(216)	
Fuel for water heating, kWh/month	188.9211	166.1155	173.5186	154.4035	151.0982	135.8614	128.8453	143.6483	144.1122	160.3432	170.8571	183.7790	(219)	
Water heating fuel used												1901.5034	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3427.8343	(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)													334.3640	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.55 * 1080 * 1.00) =													-474.9908	(233)
Total delivered energy for all uses													5263.7109	(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	3427.8343	0.2160	740.4122	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1901.5034	0.2160	410.7247	(264)
Space and water heating			1151.1369	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	334.3640	0.5190	173.5349	(268)
Energy saving/generation technologies				
PV Unit	-474.9908	0.5190	-246.5202	(269)
Total CO2, kg/year			1117.0766	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.5500	(273)

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

DER		15.5500	ZC1
Total Floor Area		71.8600	
Assumed number of occupants		2.2904	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		16.6244	ZC2
CO2 emissions from cooking, equation (L16)		2.4210	ZC3
Total CO2 emissions		34.5954	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.5954	ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4431	0.4342	0.3899	0.3810	0.3367	0.3367	0.3279	0.3544	0.3810	0.3987	0.4165 (22b)
Effective ac	0.6021	0.5981	0.5943	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			10.9600	1.3258	14.5303		(27)
Ground Floor			35.9300	0.1300	4.6709		(28a)
Brick and Block	69.7200	10.9300	58.7900	0.1800	10.5822		(29a)
Tile Hung	12.1400	2.1800	9.9600	0.1800	1.7928		(29a)
Cold Party Wall	3.8100		3.8100	0.1800	0.6858		(29a)
Pitched Roof	35.9300		35.9300	0.1300	4.6709		(30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		39.0829		(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)							9.6353 (36)
Total fabric heat loss						(33) + (36) =	48.7182 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	35.6960	35.4609	35.2305	34.1482	33.9457	33.0031	33.0031	32.8285	33.3662	33.9457	34.3554	34.7836 (38)
Heat transfer coeff	84.4142	84.1791	83.9487	82.8664	82.6639	81.7213	81.7213	81.5468	82.0844	82.6639	83.0736	83.5018 (39)
Average = Sum(39)m / 12 =												82.8655 (39)
HLP	1.1747	1.1714	1.1682	1.1532	1.1503	1.1372	1.1372	1.1348	1.1423	1.1503	1.1560	1.1620 (40)
HLP (average)												1.1532 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)
Energy conte	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Energy content (annual)										Total = Sum(45)m =		1393.9836 (45)
Distribution loss (46)m = 0.15 x (45)m												
21.6789	18.9605	19.5656	17.0577	16.3673	14.1237	13.0877	15.0184	15.1977	17.7115	19.3335	20.9949 (46)	
Water storage loss:												
Total storage loss												

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 (56)
Combi loss	49.6631	43.2259	46.0513	42.8181	42.4394	39.3227	40.6335	42.4394	42.8181	46.0513	46.3134	49.6631 (61)
Total heat required for water heating calculated for each month	194.1894	169.6295	176.4885	156.5364	151.5548	133.4810	127.8850	142.5618	144.1363	164.1279	175.2032	189.6291 (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	194.1894	169.6295	176.4885	156.5364	151.5548	133.4810	127.8850	142.5618	144.1363	164.1279	175.2032	189.6291 (64)
Heat gains from water heating, kWh/month	60.4708	52.8357	54.8832	48.5159	46.8907	41.1383	39.1695	43.9006	44.3928	50.7733	54.4342	58.9545 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9331	16.8162	13.6758	10.3535	7.7394	6.5339	7.0601	9.1770	12.3173	15.6397	18.2538	19.4593	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.5987	203.6906	198.4189	187.1962	173.0294	159.7147	150.8196	148.7276	153.9993	165.2221	179.3888	192.7036	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	(71)
Water heating gains (Table 5)	81.2779	78.6245	73.7677	67.3831	63.0252	57.1366	52.6472	59.0061	61.6567	68.2437	75.6031	79.2399	(72)
Total internal gains	362.1660	359.4876	346.2188	325.2891	304.1503	283.7414	270.8832	277.2671	288.3296	309.4617	333.6021	351.7591	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					7.8200	10.6334	0.6300	0.7000			0.7700			25.4127
South					3.1400	46.7521	0.6300	0.7000			0.7700			44.8644 (74)
Solar gains	70.2771	122.0413	176.1196	238.3379	288.7958	297.2410	282.1200	242.2519	196.9922	137.0614	84.5295	59.9523 (83)		
Total gains	432.4431	481.5289	522.3384	563.6270	592.9460	580.9824	553.0032	519.5189	485.3218	446.5231	418.1315	411.7113 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1166	59.2817	59.4444	60.2207	60.3683	61.0646	61.0646	61.1953	60.7945	60.3683	60.0706	59.7625	
alpha	4.9411	4.9521	4.9630	5.0147	5.0246	5.0710	5.0710	5.0797	5.0530	5.0246	5.0047	4.9842	
util living area	0.9980	0.9962	0.9914	0.9748	0.9216	0.7885	0.6226	0.6775	0.8920	0.9818	0.9960	0.9984	(86)
MIT	19.7274	19.8601	20.0889	20.4080	20.7094	20.9150	20.9800	20.9697	20.8253	20.4494	20.0362	19.7067	(87)
Th 2	19.9403	19.9429	19.9455	19.9577	19.9599	19.9705	19.9705	19.9725	19.9665	19.9599	19.9553	19.9505	(88)
util rest of house	0.9973	0.9948	0.9881	0.9644	0.8869	0.7009	0.4907	0.5473	0.8315	0.9723	0.9944	0.9979	(89)
MIT 2	18.2462	18.4418	18.7768	19.2446	19.6596	19.9098	19.9627	19.9591	19.8169	19.3099	18.7084	18.2232	(90)
Living area fraction	18.5746	18.7562	19.0677	19.5025	19.8923	20.1326	20.1882	20.1831	20.0405	19.5625	19.0027	18.5520	(92)
Temperature adjustment	18.5746	18.7562	19.0677	19.5025	19.8923	20.1326	20.1882	20.1831	20.0405	19.5625	19.0027	18.5520	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	430.6859	477.9734	514.1630	540.1945	524.2552	416.1681	287.5925	299.2365	406.0971	431.8975	414.8632	410.3937	(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	1204.9749	1166.4040	1055.0385	878.5912	677.2085	452.1342	293.2324	308.5024	487.6214	740.8787	988.8020	1198.4221	(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	576.0711	462.6253	402.4114	243.6456	113.7972	0.0000	0.0000	0.0000	0.0000	229.8820	413.2360	586.2931	(98)
Space heating												3027.9617	(98)
Space heating per m2												42.1370	(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													3241.9290 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	576.0711	462.6253	402.4114	243.6456	113.7972	0.0000	0.0000	0.0000	0.0000	229.8820	413.2360	586.2931	(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)	616.7784	495.3162	430.8473	260.8626	121.8386	0.0000	0.0000	0.0000	0.0000	246.1264	442.4368	627.7228	(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	194.1894	169.6295	176.4885	156.5364	151.5548	133.4810	127.8850	142.5618	144.1363	164.1279	175.2032	189.6291	(64)
Efficiency of water heater (217)m	87.6215	87.4490	87.0615	86.1609	84.3411	80.3000	80.3000	80.3000	80.3000	85.8994	87.1368	87.7040	(216)
Fuel for water heating, kWh/month	221.6229	193.9753	202.7169	181.6792	179.6927	166.2280	159.2590	177.5365	179.4972	191.0699	201.0669	216.2148	(219)
Water heating fuel used												2270.5594	(219)
Annual totals kWh/year													
Space heating fuel - main system												3241.9290	(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)												334.3640	(232)
Total delivered energy for all uses												5921.8524	(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	3241.9290	0.2160	700.2567 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2270.5594	0.2160	490.4408 (264)
Space and water heating			1190.6975 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	334.3640	0.5190	173.5349 (268)
Total CO2, kg/m2/year			1403.1574 (272)
Emissions per m2 for space and water heating			16.5697 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4149 (272b)
Emissions per m2 for pumps and fans			0.5417 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.5697 * 1.00) + 2.4149 + 0.5417, rounded to 2 d.p.			19.5300 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4431	0.4342	0.3899	0.3810	0.3367	0.3367	0.3279	0.3544	0.3810	0.3987	0.4165 (22b)
Effective ac	0.6021	0.5981	0.5943	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.9300	0.1200	4.3116	84.0000	3018.1200 (28a)
Brick and Block	69.7200	10.9300	58.7900	0.2400	14.1096	42.2200	2482.1138 (29a)
Tile Hung	12.1400	2.1800	9.9600	0.2400	2.3904	42.2200	420.5112 (29a)
Cold Party Wall	3.8100		3.8100	0.2600	0.9906	113.5000	432.4350 (29a)
Pitched Roof	35.9300		35.9300	0.1000	3.5930	9.1000	326.9630 (30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.3098		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			58.9100			9.0000	530.1900 (32c)
First Floor Stud			60.4000			9.0000	543.6000 (32c)
Internal Floor 1			35.9300			18.0000	646.7400 (32d)
Internal Ceiling 1			35.9300			9.0000	323.3700 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13380.3430 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							186.2002 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7483 (36)
Total fabric heat loss						(33) + (36) =	48.0581 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6960	35.4609	35.2305	34.1482	33.9457	33.0031	33.0031	32.8285	33.3662	33.9457	34.3554	34.7836 (38)
Heat transfer coeff	83.7541	83.5190	83.2886	82.2063	82.0038	81.0612	81.0612	80.8867	81.4243	82.0038	82.4135	82.8417 (39)
Average = Sum(39)m / 12 =												82.2054 (39)
HLP	1.1655	1.1622	1.1590	1.1440	1.1412	1.1280	1.1280	1.1256	1.1331	1.1412	1.1469	1.1528 (40)
HLP (average)												1.1440 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Energy content (annual)										Total =	Sum (45)m =	1393.9836 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.7118	26.8608	27.7179	24.1651	23.1870	20.0086	18.5409	21.2760	21.5301	25.0913	27.3891	29.7428 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9331	16.8162	13.6758	10.3535	7.7394	6.5339	7.0601	9.1770	12.3173	15.6397	18.2538	19.4593 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.5987	203.6906	198.4189	187.1962	173.0294	159.7147	150.8196	148.7276	153.9993	165.2221	179.3888	192.7036 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168 (71)
Water heating gains (Table 5)	41.2793	39.9714	37.2552	33.5627	31.1654	27.7898	24.9206	28.5968	29.9029	33.7248	38.0404	39.9768 (72)
Total internal gains	319.1674	317.8345	306.7063	288.4687	269.2904	251.3946	240.1566	243.8577	253.5759	271.9429	293.0394	309.4960 (73)

6. Solar gains

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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	44.3771	44.5020	44.6251	45.2126	45.3242	45.8513	45.8513	45.9502	45.6468	45.3242	45.0990	44.8658
alpha	3.9585	3.9668	3.9750	4.0142	4.0216	4.0568	4.0568	4.0633	4.0431	4.0216	4.0066	3.9911
util living area	0.9954	0.9920	0.9841	0.9617	0.9035	0.7792	0.6290	0.6837	0.8792	0.9722	0.9921	0.9963 (86)
MIT	19.3505	19.5170	19.8032	20.1999	20.5761	20.8498	20.9537	20.9346	20.7276	20.2532	19.7369	19.3251 (87)
Th 2	19.9477	19.9503	19.9529	19.9651	19.9674	19.9780	19.9780	19.9800	19.9739	19.9674	19.9627	19.9579 (88)
util rest of house	0.9942	0.9899	0.9797	0.9498	0.8703	0.7012	0.5054	0.5640	0.8249	0.9613	0.9896	0.9953 (89)
MIT 2	18.4413	18.6090	18.8950	19.2941	19.6520	19.8936	19.9618	19.9546	19.7987	19.3522	18.8381	18.4237 (90)
Living area fraction									fLA = Living area / (4) =			0.2217 (91)
MIT	18.6428	18.8103	19.0963	19.4949	19.8568	20.1056	20.1816	20.1719	20.0046	19.5519	19.0374	18.6235 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6428	18.8103	19.0963	19.4949	19.8568	20.1056	20.1816	20.1719	20.0046	19.5519	19.0374	18.6235 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9921	0.9867	0.9748	0.9429	0.8661	0.7121	0.5319	0.5887	0.8268	0.9555	0.9866	0.9936 (94)
Ext temp.	386.3865	434.0275	470.6496	496.7245	483.3683	390.6885	277.7788	286.1917	372.5449	390.8051	372.5112	367.0843 (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	1201.2706	1161.7711	1049.1320	870.9657	668.8929	446.2907	290.3327	305.0951	480.7785	734.0922	983.8000	1194.8699 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	606.2738	489.0437	430.3909	269.4536	138.0303	0.0000	0.0000	0.0000	0.0000	255.4056	440.1280	615.8725 (98)
Space heating per m2										(98) / (4) =		3244.5983 (98)
												45.1517 (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	761.9754	599.8530	614.7386	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	0.7828	0.8562	0.8262	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	596.4956	513.5644	507.9276	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	726.7705	694.2668	653.5137	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	93.7979	134.4425	108.3161	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												336.5565 (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	23.4495	33.6106	27.0790	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												84.1391 (107)
Space cooling per m2												1.1709 (108)
Energy for space heating												45.1517 (99)
Energy for space cooling												1.1709 (108)
Total												46.3225 (109)
Dwelling Fabric Energy Efficiency (DFEE)												46.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4431	0.4342	0.3899	0.3810	0.3367	0.3367	0.3279	0.3544	0.3810	0.3987	0.4165 (22b)
Effective ac	0.6021	0.5981	0.5943	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			10.9600	1.3258	14.5303		(27)
Ground Floor			35.9300	0.1300	4.6709		(28a)
Brick and Block	69.7200	10.9300	58.7900	0.1800	10.5822		(29a)
Tile Hung	12.1400	2.1800	9.9600	0.1800	1.7928		(29a)
Cold Party Wall	3.8100		3.8100	0.1800	0.6858		(29a)
Pitched Roof	35.9300		35.9300	0.1300	4.6709		(30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0829		(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)							9.6353 (36)
Total fabric heat loss						(33) + (36) =	48.7182 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	35.6960	35.4609	35.2305	34.1482	33.9457	33.0031	33.0031	32.8285	33.3662	33.9457	34.3554	34.7836 (38)
Heat transfer coeff	84.4142	84.1791	83.9487	82.8664	82.6639	81.7213	81.7213	81.5468	82.0844	82.6639	83.0736	83.5018 (39)
Average = Sum(39)m / 12 =												82.8655 (39)
HLP	1.1747	1.1714	1.1682	1.1532	1.1503	1.1372	1.1372	1.1348	1.1423	1.1503	1.1560	1.1620 (40)
HLP (average)												1.1532 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)
Energy conte	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Energy content (annual)										Total = Sum(45)m =		1393.9836 (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												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.7118	26.8608	27.7179	24.1651	23.1870	20.0086	18.5409	21.2760	21.5301	25.0913	27.3891	29.7428 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	114.5210	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.9331	16.8162	13.6758	10.3535	7.7394	6.5339	7.0601	9.1770	12.3173	15.6397	18.2538	19.4593	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	201.5987	203.6906	198.4189	187.1962	173.0294	159.7147	150.8196	148.7276	153.9993	165.2221	179.3888	192.7036	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	34.4521	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	(71)
Water heating gains (Table 5)	41.2793	39.9714	37.2552	33.5627	31.1654	27.7898	24.9206	28.5968	29.9029	33.7248	38.0404	39.9768	(72)
Total internal gains	319.1674	317.8345	306.7063	288.4687	269.2904	251.3946	240.1566	243.8577	253.5759	271.9429	293.0394	309.4960	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	7.8200				10.6334		0.6300		0.7000		0.7700		25.4127	
South	3.1400				46.7521		0.6300		0.7000		0.7700		44.8644 (78)	
Solar gains	70.2771	122.0413	176.1196	238.3379	288.7958	297.2410	282.1200	242.2519	196.9922	137.0614	84.5295	59.9523 (83)		
Total gains	389.4445	439.8758	482.8259	526.8065	558.0862	548.6356	522.2767	486.1096	450.5681	409.0043	377.5688	369.4483 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	59.1166	59.2817	59.4444	60.2207	60.3683	61.0646	61.0646	61.1953	60.7945	60.3683	60.0706	59.7625		
alpha	4.9411	4.9521	4.9630	5.0147	5.0246	5.0710	5.0710	5.0797	5.0530	5.0246	5.0047	4.9842		
util living area	0.9987	0.9974	0.9938	0.9808	0.9359	0.8147	0.6524	0.7121	0.9141	0.9873	0.9975	0.9990	(86)	
MIT	19.6719	19.8068	20.0395	20.3652	20.6779	20.9004	20.9753	20.9621	20.7978	20.4042	19.9842	19.6519	(87)	
Th 2	19.9403	19.9429	19.9455	19.9577	19.9599	19.9705	19.9705	19.9725	19.9665	19.9599	19.9553	19.9505	(88)	
util rest of house	0.9983	0.9965	0.9915	0.9725	0.9057	0.7304	0.5175	0.5807	0.8613	0.9804	0.9964	0.9987	(89)	
MIT 2	18.7284	18.8651	19.0988	19.4300	19.7282	19.9206	19.9638	19.9606	19.8441	19.4728	19.0523	18.7166	(90)	
Living area fraction													0.2217	(91)
MIT	18.9375	19.0738	19.3073	19.6373	19.9387	20.1378	20.1880	20.1826	20.0555	19.6793	19.2589	18.9239	(92)	
Temperature adjustment													0.0000	
adjusted MIT	18.9375	19.0738	19.3073	19.6373	19.9387	20.1378	20.1880	20.1826	20.0555	19.6793	19.2589	18.9239	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	388.5557	437.8866	477.7788	510.5981	505.0575	409.2393	286.1185	296.5252	390.5854	399.9582	375.8467	368.8025	(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	1235.6155	1193.1397	1075.1575	889.7624	681.0454	452.5540	293.2165	308.4612	488.8544	750.5305	1010.0817	1229.4740	(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	630.2125	507.5301	444.4498	272.9983	130.9350	0.0000	0.0000	0.0000	0.0000	260.8258	456.6492	640.3396	(98)
Space heating												3343.9403	(98)
Space heating per m2												46.5341	(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	768.1803	604.7377	619.7553	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8113	0.8872	0.8569	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	623.2253	536.5056	531.0384	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	726.7705	694.2668	653.5137	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	74.5525	117.3743	91.1216	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling											283.0484 (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	18.6381	29.3436	22.7804	0.0000	0.0000	0.0000 (107)
Space cooling											70.7621 (107)
Space cooling per m2											0.9847 (108)
Energy for space heating											46.5341 (99)
Energy for space cooling											0.9847 (108)
Total											47.5188 (109)
Target Fabric Energy Efficiency (TFEE)											54.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4165	0.4076	0.3810	0.3810	0.3544	0.3544	0.3456	0.3544	0.3987	0.3899	0.4165 (22b)
Effective ac	0.6021	0.5867	0.5831	0.5726	0.5726	0.5628	0.5628	0.5597	0.5628	0.5795	0.5760	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.9300	0.1200	4.3116	84.0000	3018.1200 (28a)
Brick and Block	69.7200	10.9300	58.7900	0.2400	14.1096	42.2200	2482.1138 (29a)
Tile Hung	12.1400	2.1800	9.9600	0.2400	2.3904	42.2200	420.5112 (29a)
Cold Party Wall	3.8100		3.8100	0.2600	0.9906	113.5000	432.4350 (29a)
Pitched Roof	35.9300		35.9300	0.1000	3.5930	9.1000	326.9630 (30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.3098		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			58.9100			9.0000	530.1900 (32c)
First Floor Stud			60.4000			9.0000	543.6000 (32c)
Internal Floor 1			35.9300			18.0000	646.7400 (32d)
Internal Ceiling 1			35.9300			18.0000	646.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13703.7130 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.7002 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7483 (36)
Total fabric heat loss						(33) + (36) =	48.0581 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6960	34.7836	34.5672	33.9457	33.9457	33.3662	33.3662	33.1823	33.3662	34.3554	34.1482	34.7836 (38)
Heat transfer coeff	83.7541	82.8417	82.6253	82.0038	82.0038	81.4243	81.4243	81.2404	81.4243	82.4135	82.2063	82.8417 (39)
Average = Sum(39)m / 12 =												82.1836 (39)
HLP	1.1655	1.1528	1.1498	1.1412	1.1412	1.1331	1.1331	1.1305	1.1331	1.1469	1.1440	1.1528 (40)
HLP (average)												1.1437 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Distribution loss (46)m = 0.15 x (45)m	21.6789	18.9605	19.5656	17.0577	16.3673	14.1237	13.0877	15.0184	15.1977	17.7115	19.3335	20.9949 (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	25.2941	22.8233	25.2320	24.3767	25.1591	24.3128	25.1016	25.1389	24.3476	25.2019	24.4369	25.2821 (61)
Total heat required for water heating calculated for each month	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	54.3785	47.7350	49.6784	43.9055	42.5707	37.3858	35.2865	39.5754	39.7752	45.5609	48.9651	52.8592 (65)
												1691 (64)
												1690.6906 (64)
												1691 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3327	42.0405	34.1896	25.8837	19.3484	16.3347	17.6502	22.9425	30.7933	39.0992	45.6345	48.6482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.8935	304.0158	296.1477	279.3972	258.2528	238.3801	225.1039	221.9815	229.8497	246.6001	267.7445	287.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168 (71)
Water heating gains (Table 5)	73.0894	71.0343	66.7720	60.9799	57.2186	51.9248	47.4281	53.1928	55.2433	61.2378	68.0071	71.0473 (72)
Total internal gains	521.1569	516.9319	496.9506	466.1022	434.6612	406.4810	390.0236	397.9581	415.7277	446.7785	481.2275	507.1542 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North				7.8200	13.8645	0.6300	0.7000			0.7700			33.1348 (74)
South				3.1400	58.2505	0.6300	0.7000			0.7700			55.8986 (78)
Solar gains	89.0334	132.6926	192.1968	267.7344	311.8101	347.9059	322.0980	281.2921	228.9646	158.0818	106.2174	72.4659 (83)	
Total gains	610.1904	649.6245	689.1474	733.8366	746.4713	754.3869	712.1216	679.2502	644.6924	604.8603	587.4449	579.6201 (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	45.4496	45.9501	46.0705	46.4196	46.4196	46.7500	46.7500	46.8558	46.7500	46.1889	46.3053	45.9501
alpha	4.0300	4.0633	4.0714	4.0946	4.0946	4.1167	4.1167	4.1237	4.1167	4.0793	4.0870	4.0633
util living area	0.9747	0.9666	0.9436	0.8874	0.7702	0.5719	0.4159	0.4338	0.6805	0.8821	0.9549	0.9779 (86)
MIT	19.8589	19.9719	20.2251	20.5429	20.8164	20.9603	20.9918	20.9905	20.9195	20.6384	20.2351	19.8471 (87)
Th 2	19.9477	19.9579	19.9604	19.9674	19.9674	19.9739	19.9739	19.9760	19.9739	19.9627	19.9651	19.9579 (88)
util rest of house	0.9683	0.9583	0.9291	0.8580	0.7110	0.4796	0.3041	0.3181	0.5902	0.8433	0.9415	0.9723 (89)
MIT 2	18.9416	19.0600	19.3076	19.6119	19.8490	19.9568	19.9720	19.9738	19.9344	19.7010	19.3246	18.9385 (90)
Living area fraction									fLA = Living area / (4) =			0.2217 (91)
MIT	19.1450	19.2621	19.5110	19.8183	20.0634	20.1792	20.1981	20.1992	20.1528	19.9088	19.5265	19.1399 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1450	19.2621	19.5110	19.8183	20.0634	20.1792	20.1981	20.1992	20.1528	19.9088	19.5265	19.1399 (93)

8. Space heating requirement

Utilisation	0.9620	0.9514	0.9215	0.8531	0.7170	0.4989	0.3290	0.3439	0.6072	0.8410	0.9345	0.9665 (94)
Useful gains	587.0314	618.0727	635.0514	626.0366	535.2155	376.3655	234.2967	233.5699	391.4413	508.6793	548.9964	560.2237 (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	1151.1997	1123.5101	1008.9357	837.9380	612.0307	389.1467	235.9749	235.5296	419.5598	668.2738	914.6649	1129.9513 (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	419.7412	339.6540	278.1699	152.5690	57.1505	0.0000	0.0000	0.0000	0.0000	118.7383	263.2814	423.8774 (98)
Space heating												2053.1817 (98)
RHI space heating demand												2053 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4431	0.4342	0.3899	0.3810	0.3367	0.3367	0.3279	0.3544	0.3810	0.3987	0.4165 (22b)
Effective ac	0.6021	0.5981	0.5943	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.9300	0.1200	4.3116	84.0000	3018.1200 (28a)
Brick and Block	69.7200	10.9300	58.7900	0.2400	14.1096	42.2200	2482.1138 (29a)
Tile Hung	12.1400	2.1800	9.9600	0.2400	2.3904	42.2200	420.5112 (29a)
Cold Party Wall	3.8100		3.8100	0.2600	0.9906	113.5000	432.4350 (29a)
Pitched Roof	35.9300		35.9300	0.1000	3.5930	9.1000	326.9630 (30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.3098		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			58.9100			9.0000	530.1900 (32c)
First Floor Stud			60.4000			9.0000	543.6000 (32c)
Internal Floor 1			35.9300			18.0000	646.7400 (32d)
Internal Ceiling 1			35.9300			18.0000	646.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13703.7130 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.7002 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7483 (36)
Total fabric heat loss						(33) + (36) =	48.0581 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6960	35.4609	35.2305	34.1482	33.9457	33.0031	33.0031	32.8285	33.3662	33.9457	34.3554	34.7836 (38)
Heat transfer coeff	83.7541	83.5190	83.2886	82.2063	82.0038	81.0612	81.0612	80.8867	81.4243	82.0038	82.4135	82.8417 (39)
Average = Sum(39)m / 12 =												82.2054 (39)
HLP	1.1655	1.1622	1.1590	1.1440	1.1412	1.1280	1.1280	1.1256	1.1331	1.1412	1.1469	1.1528 (40)
HLP (average)												1.1440 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Energy content (annual)										Total =	Sum (45)m =	1393.9836 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.6789	18.9605	19.5656	17.0577	16.3673	14.1237	13.0877	15.0184	15.1977	17.7115	19.3335	20.9949 (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	25.2941	22.8233	25.2320	24.3767	25.1591	24.3128	25.1016	25.1389	24.3476	25.2019	24.4369	25.2821 (61)
Total heat required for water heating calculated for each month												
Solar input	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (64)
								Total per year (kWh/year) =	Sum (64)m =			1690.6906 (64)
Heat gains from water heating, kWh/month												
	54.3785	47.7350	49.6784	43.9055	42.5707	37.3858	35.2865	39.5754	39.7752	45.5609	48.9651	52.8592 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	47.3327	42.0405	34.1896	25.8837	19.3484	16.3347	17.6502	22.9425	30.7933	39.0992	45.6345	48.6482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	300.8935	304.0158	296.1477	279.3972	258.2528	238.3801	225.1039	221.9815	229.8497	246.6001	267.7445	287.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168 (71)
Water heating gains (Table 5)												
	73.0894	71.0343	66.7720	60.9799	57.2186	51.9248	47.4281	53.1928	55.2433	61.2378	68.0071	71.0473 (72)
Total internal gains												
	521.1569	516.9319	496.9506	466.1022	434.6612	406.4810	390.0236	397.9581	415.7277	446.7785	481.2275	507.1542 (73)

6. Solar gains

[Jan]												Gains	
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North	7.8200				10.6334		0.6300		0.7000		0.7700		25.4127
South	3.1400				46.7521		0.6300		0.7000		0.7700		44.8644 (74)
Solar gains	70.2771	122.0413	176.1196	238.3379	288.7958	297.2410	282.1200	242.2519	196.9922	137.0614	84.5295	59.9523	(83)
Total gains	591.4341	638.9733	673.0702	704.4401	723.4570	703.7220	672.1436	640.2100	612.7199	583.8399	565.7570	567.1064	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.4496	45.5775	45.7036	46.3053	46.4196	46.9594	46.9594	47.0608	46.7500	46.4196	46.1889	45.9501
alpha	4.0300	4.0385	4.0469	4.0870	4.0946	4.1306	4.1306	4.1374	4.1167	4.0946	4.0793	4.0633
util living area												
	0.9818	0.9734	0.9562	0.9139	0.8243	0.6677	0.5117	0.5537	0.7682	0.9218	0.9707	0.9844 (86)
MIT	19.6887	19.8407	20.0944	20.4348	20.7320	20.9209	20.9795	20.9716	20.8528	20.4929	20.0400	19.6601 (87)
Th 2	19.9477	19.9503	19.9529	19.9651	19.9674	19.9780	19.9780	19.9800	19.9739	19.9674	19.9627	19.9579 (88)
util rest of house												
	0.9774	0.9669	0.9450	0.8909	0.7768	0.5838	0.4014	0.4428	0.6946	0.8964	0.9625	0.9806 (89)
MIT 2	18.7735	18.9250	19.1753	19.5108	19.7804	19.9374	19.9715	19.9702	19.8888	19.5728	19.1329	18.7534 (90)
Living area fraction												
MIT	18.9764	19.1280	19.3791	19.7157	19.9914	20.1554	20.1949	20.1922	20.1025	19.7767	19.3340	18.9544 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9764	19.1280	19.3791	19.7157	19.9914	20.1554	20.1949	20.1922	20.1025	19.7767	19.3340	18.9544 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9721	0.9605	0.9376	0.8844	0.7780	0.5994	0.4257	0.4670	0.7048	0.8907	0.9561	0.9758 (94)
Useful gains	574.9278	613.7545	631.0437	623.0371	562.8582	421.7894	286.1090	298.9480	431.8658	520.0391	540.9230	553.4075 (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												
	1229.2059	1188.3091	1072.6781	889.1152	679.9233	450.3306	291.4109	306.7354	488.7521	752.5274	1008.2446	1222.2799 (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												
	486.7829	386.1007	328.5760	191.5763	87.0964	0.0000	0.0000	0.0000	0.0000	172.9713	336.4716	497.6411 (98)
Space heating												2487.2164 (98)
Space heating per m2										(98) / (4) =		34.6120 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.7000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2742.2452	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	486.7829	386.1007	328.5760	191.5763	87.0964	0.0000	0.0000	0.0000	0.0000	172.9713	336.4716	497.6411	(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)	536.6956	425.6899	362.2669	211.2197	96.0269	0.0000	0.0000	0.0000	0.0000	190.7071	370.9720	548.6671	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481	(64)	
Efficiency of water heater (217)m	89.7681	89.6964	89.5446	89.2003	88.5443	87.2000	87.2000	87.2000	87.2000	89.0801	89.5745	89.8015	(216)	
Fuel for water heating, kWh/month	189.1767	166.3688	173.8455	154.8146	151.6467	135.8614	128.8453	143.6483	144.1122	160.8422	171.1723	184.0149	(219)	
Water heating fuel used													1904.3488	(219)
Annual totals kWh/year														
Space heating fuel - main system													2742.2452	(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)													334.3640	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.55 * 1080 * 1.00) =										-474.9908			-474.9908	(233)
Total delivered energy for all uses													4580.9671	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2742.2452	3.4800	95.4301 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1904.3488	3.4800	66.2713 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	334.3640	13.1900	44.1026 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-474.9908	13.1900	-62.6513 (252)
Total energy cost			273.0453 (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] =	0.9813 (257)
SAP value		86.3104
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2742.2452	0.2160	592.3250 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1904.3488	0.2160	411.3393 (264)
Space and water heating			1003.6643 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	334.3640	0.5190	173.5349 (268)
Energy saving/generation technologies			
PV Unit	-474.9908	0.5190	-246.5202 (269)
Total kg/year			969.6040 (272)
CO2 emissions per m2			13.4900 (273)
EI value			88.8818
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9070 = 3.837$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9070 = 0.2381$, stars = 4
Water heating energy efficiency	$3.48 / 0.8867 = 3.925$, stars = 4
Water heating environmental impact	$0.216 / 0.8867 = 0.2436$, 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	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4165	0.4076	0.3810	0.3810	0.3544	0.3544	0.3456	0.3544	0.3987	0.3899	0.4165 (22b)
Effective ac	0.6021	0.5867	0.5831	0.5726	0.5726	0.5628	0.5628	0.5597	0.5628	0.5795	0.5760	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.9300	0.1200	4.3116	84.0000	3018.1200 (28a)
Brick and Block	69.7200	10.9300	58.7900	0.2400	14.1096	42.2200	2482.1138 (29a)
Tile Hung	12.1400	2.1800	9.9600	0.2400	2.3904	42.2200	420.5112 (29a)
Cold Party Wall	3.8100		3.8100	0.2600	0.9906	113.5000	432.4350 (29a)
Pitched Roof	35.9300		35.9300	0.1000	3.5930	9.1000	326.9630 (30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.3098		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			58.9100			9.0000	530.1900 (32c)
First Floor Stud			60.4000			9.0000	543.6000 (32c)
Internal Floor 1			35.9300			18.0000	646.7400 (32d)
Internal Ceiling 1			35.9300			18.0000	646.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13703.7130 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.7002 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7483 (36)
Total fabric heat loss						(33) + (36) =	48.0581 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6960	34.7836	34.5672	33.9457	33.9457	33.3662	33.3662	33.1823	33.3662	34.3554	34.1482	34.7836 (38)
Heat transfer coeff	83.7541	82.8417	82.6253	82.0038	82.0038	81.4243	81.4243	81.2404	81.4243	82.4135	82.2063	82.8417 (39)
Average = Sum(39)m / 12 =												82.1836 (39)
HLP	1.1655	1.1528	1.1498	1.1412	1.1412	1.1331	1.1331	1.1305	1.1331	1.1469	1.1440	1.1528 (40)
HLP (average)												1.1437 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy conte	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Energy content (annual)										Total =	Sum (45)m =	1393.9836 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.6789	18.9605	19.5656	17.0577	16.3673	14.1237	13.0877	15.0184	15.1977	17.7115	19.3335	20.9949 (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	25.2941	22.8233	25.2320	24.3767	25.1591	24.3128	25.1016	25.1389	24.3476	25.2019	24.4369	25.2821 (61)
Total heat required for water heating calculated for each month												
	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) =	Sum (63)m =			0.0000 (63)
Output from w/h												
	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (64)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1690.6906 (64)
	54.3785	47.7350	49.6784	43.9055	42.5707	37.3858	35.2865	39.5754	39.7752	45.5609	48.9651	52.8592 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	47.3327	42.0405	34.1896	25.8837	19.3484	16.3347	17.6502	22.9425	30.7933	39.0992	45.6345	48.6482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	300.8935	304.0158	296.1477	279.3972	258.2528	238.3801	225.1039	221.9815	229.8497	246.6001	267.7445	287.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168 (71)
Water heating gains (Table 5)												
	73.0894	71.0343	66.7720	60.9799	57.2186	51.9248	47.4281	53.1928	55.2433	61.2378	68.0071	71.0473 (72)
Total internal gains												
	521.1569	516.9319	496.9506	466.1022	434.6612	406.4810	390.0236	397.9581	415.7277	446.7785	481.2275	507.1542 (73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF		Access		Gains
				m2	Table 6a	or Table 6b		or Table 6c		factor		W
					W/m2					Table 6d		
North				7.8200	13.8645	0.6300		0.7000		0.7700		33.1348
South				3.1400	58.2505	0.6300		0.7000		0.7700		55.8986 (74)
Solar gains	89.0334	132.6926	192.1968	267.7344	311.8101	347.9059	322.0980	281.2921	228.9646	158.0818	106.2174	72.4659 (83)
Total gains	610.1904	649.6245	689.1474	733.8366	746.4713	754.3869	712.1216	679.2502	644.6924	604.8603	587.4449	579.6201 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	45.4496	45.9501	46.0705	46.4196	46.4196	46.7500	46.7500	46.8558	46.7500	46.1889	46.3053	45.9501
alpha	4.0300	4.0633	4.0714	4.0946	4.0946	4.1167	4.1167	4.1237	4.1167	4.0793	4.0870	4.0633
util living area												
	0.9747	0.9666	0.9436	0.8874	0.7702	0.5719	0.4159	0.4338	0.6805	0.8821	0.9549	0.9779 (86)
MIT	19.8589	19.9719	20.2251	20.5429	20.8164	20.9603	20.9918	20.9905	20.9195	20.6384	20.2351	19.8471 (87)
Th 2	19.9477	19.9579	19.9604	19.9674	19.9674	19.9739	19.9739	19.9760	19.9739	19.9627	19.9651	19.9579 (88)
util rest of house												
	0.9683	0.9583	0.9291	0.8580	0.7110	0.4796	0.3041	0.3181	0.5902	0.8433	0.9415	0.9723 (89)
MIT 2	18.9416	19.0600	19.3076	19.6119	19.8490	19.9568	19.9720	19.9738	19.9344	19.7010	19.3246	18.9385 (90)
Living area fraction												
	19.1450	19.2621	19.5110	19.8183	20.0634	20.1792	20.1981	20.1992	20.1528	19.9088	19.5265	19.1399 (92)
MIT												
Temperature adjustment												0.0000
adjusted MIT	19.1450	19.2621	19.5110	19.8183	20.0634	20.1792	20.1981	20.1992	20.1528	19.9088	19.5265	19.1399 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9620	0.9514	0.9215	0.8531	0.7170	0.4989	0.3290	0.3439	0.6072	0.8410	0.9345	0.9665 (94)
Useful gains	587.0314	618.0727	635.0514	626.0366	535.2155	376.3655	234.2967	233.5699	391.4413	508.6793	548.9964	560.2237 (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												
	1151.1997	1123.5101	1008.9357	837.9380	612.0307	389.1467	235.9749	235.5296	419.5598	668.2738	914.6649	1129.9513 (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												
	419.7412	339.6540	278.1699	152.5690	57.1505	0.0000	0.0000	0.0000	0.0000	118.7383	263.2814	423.8774 (98)
Space heating												2053.1817 (98)
Space heating per m2										(98) / (4) =		28.5720 (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													2263.7064	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	419.7412	339.6540	278.1699	152.5690	57.1505	0.0000	0.0000	0.0000	0.0000	118.7383	263.2814	423.8774	(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)	462.7797	374.4807	306.6923	168.2128	63.0105	0.0000	0.0000	0.0000	0.0000	130.9132	290.2771	467.3400	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481	(64)	
Efficiency of water heater (217)m	89.6634	89.6022	89.4123	89.0028	88.2163	87.2000	87.2000	87.2000	87.2000	88.7520	89.3797	89.6902	(216)	
Fuel for water heating, kWh/month	189.3977	166.5437	174.1028	155.1581	152.2106	135.8614	128.8453	143.6483	144.1122	161.4368	171.5454	184.2431	(219)	
Water heating fuel used												1907.1054	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2263.7064	(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)													334.3640	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.55 * 1234 * 1.00) =									-543.1645				-543.1645	(233)
Total delivered energy for all uses													4037.0112	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2263.7064	10.2300	231.5772	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1907.1054	10.2300	195.0969	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	334.3640	36.7200	122.7784	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-543.1645	36.7200	-199.4500	(252)
Total energy cost			480.5425	(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	2263.7064	0.2160	488.9606	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.1054	0.2160	411.9348	(264)
Space and water heating			900.8953	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	334.3640	0.5190	173.5349	(268)
Energy saving/generation technologies				
PV Unit	-543.1645	0.5190	-281.9024	(269)
Total kg/year			831.4528	(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	2263.7064	1.2200	2761.7218	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1907.1054	1.2200	2326.6685	(264)
Space and water heating			5088.3904	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	334.3640	3.0700	1026.4974	(268)
Energy saving/generation technologies				
PV Unit	-543.1645	3.0700	-1667.5152	(269)
Primary energy kWh/year			4677.6226	(272)
Primary energy kWh/m2/year			65.0936	(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 86
Current environmental impact rating: B 89

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 82	-186 kg (22.4%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£82	2.59 kg/m²	B 88	B 91
Total Savings	£82	2.59 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	£150	£169	-£18
Mains gas	£530	£429	£100
Space heating	£362	£362	£0
Water heating	£195	£113	£82
Lighting	£123	£123	£0
Generated (PV)	-£199	-£199	£0
Total cost of fuels	£481	£399	£82
Total cost of uses	£481	£399	£82
Delivered energy	56 kWh/m²	43 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	12 kg/m²	9 kg/m²	3 kg/m²
Primary energy	65 kWh/m²	51 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4431	0.4342	0.3899	0.3810	0.3367	0.3367	0.3279	0.3544	0.3810	0.3987	0.4165 (22b)
Effective ac	0.6021	0.5981	0.5943	0.5760	0.5726	0.5567	0.5567	0.5537	0.5628	0.5726	0.5795	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.9300	0.1200	4.3116	84.0000	3018.1200 (28a)
Brick and Block	69.7200	10.9300	58.7900	0.2400	14.1096	42.2200	2482.1138 (29a)
Tile Hung	12.1400	2.1800	9.9600	0.2400	2.3904	42.2200	420.5112 (29a)
Cold Party Wall	3.8100		3.8100	0.2600	0.9906	113.5000	432.4350 (29a)
Pitched Roof	35.9300		35.9300	0.1000	3.5930	9.1000	326.9630 (30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.3098		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			58.9100			9.0000	530.1900 (32c)
First Floor Stud			60.4000			9.0000	543.6000 (32c)
Internal Floor 1			35.9300			18.0000	646.7400 (32d)
Internal Ceiling 1			35.9300			18.0000	646.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13703.7130 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.7002 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7483 (36)
Total fabric heat loss						(33) + (36) =	48.0581 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6960	35.4609	35.2305	34.1482	33.9457	33.0031	33.0031	32.8285	33.3662	33.9457	34.3554	34.7836 (38)
Heat transfer coeff	83.7541	83.5190	83.2886	82.2063	82.0038	81.0612	81.0612	80.8867	81.4243	82.0038	82.4135	82.8417 (39)
Average = Sum(39)m / 12 =												82.2054 (39)
HLP	1.1655	1.1622	1.1590	1.1440	1.1412	1.1280	1.1280	1.1256	1.1331	1.1412	1.1469	1.1528 (40)
HLP (average)												1.1440 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Distribution loss (46)m = 0.15 x (45)m	21.6789	18.9605	19.5656	17.0577	16.3673	14.1237	13.0877	15.0184	15.1977	17.7115	19.3335	20.9949 (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	25.2941	22.8233	25.2320	24.3767	25.1591	24.3128	25.1016	25.1389	24.3476	25.2019	24.4369	25.2821 (61)
Total heat required for water heating calculated for each month	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (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												1.3010 (H8)
Utilisation factor												0.5364 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.5975 (H14)
Volume ratio Veff/V												0.8465 (H15)
Solar storage volume factor												0.9667 (H16)
Solar input												-826.8106 (H17)
Solar input	-23.9759	-40.0088	-68.1396	-91.3205	-112.8188	-110.9188	-109.4530	-95.6296	-74.8972	-51.1460	-28.4388	-20.0637 (63)
Solar input (sum of months) = Sum (63)m =												-826.8106 (63)
Output from w/h	145.8445	109.2181	87.5296	46.7745	21.4558	7.5523	2.9002	29.6317	50.7686	92.1325	124.8879	145.1844 (64)
Total per year (kWh/year) = Sum (64)m =												863.8800 (64)
Heat gains from water heating, kWh/month	54.3785	47.7350	49.6784	43.9055	42.5707	37.3858	35.2865	39.5754	39.7752	45.5609	48.9651	52.8592 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3327	42.0405	34.1896	25.8837	19.3484	16.3347	17.6502	22.9425	30.7933	39.0992	45.6345	48.6482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.8935	304.0158	296.1477	279.3972	258.2528	238.3801	225.1039	221.9815	229.8497	246.6001	267.7445	287.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168 (71)
Water heating gains (Table 5)	73.0894	71.0343	66.7720	60.9799	57.2186	51.9248	47.4281	53.1928	55.2433	61.2378	68.0071	71.0473 (72)
Total internal gains	521.1569	516.9319	496.9506	466.1022	434.6612	406.4810	390.0236	397.9581	415.7277	446.7785	481.2275	507.1542 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North		7.8200	10.6334	0.6300	0.7000	0.7700	25.4127 (74)
South		3.1400	46.7521	0.6300	0.7000	0.7700	44.8644 (78)

Solar gains	70.2771	122.0413	176.1196	238.3379	288.7958	297.2410	282.1200	242.2519	196.9922	137.0614	84.5295	59.9523 (83)
Total gains	591.4341	638.9733	673.0702	704.4401	723.4570	703.7220	672.1436	640.2100	612.7199	583.8399	565.7570	567.1064 (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	45.4496	45.5775	45.7036	46.3053	46.4196	46.9594	46.9594	47.0608	46.7500	46.4196	46.1889	45.9501
alpha	4.0300	4.0385	4.0469	4.0870	4.0946	4.1306	4.1306	4.1374	4.1167	4.0946	4.0793	4.0633
util living area	0.9818	0.9734	0.9562	0.9139	0.8243	0.6677	0.5117	0.5537	0.7682	0.9218	0.9707	0.9844 (86)
MIT	19.6887	19.8407	20.0944	20.4348	20.7320	20.9209	20.9795	20.9716	20.8528	20.4929	20.0400	19.6601 (87)
Th 2	19.9477	19.9503	19.9529	19.9651	19.9674	19.9780	19.9780	19.9800	19.9739	19.9674	19.9627	19.9579 (88)
util rest of house	0.9774	0.9669	0.9450	0.8909	0.7768	0.5838	0.4014	0.4428	0.6946	0.8964	0.9625	0.9806 (89)
MIT 2	18.7735	18.9250	19.1753	19.5108	19.7804	19.9374	19.9715	19.9702	19.8888	19.5728	19.1329	18.7534 (90)
Living area fraction									fLA = Living area / (4) =			0.2217 (91)
MIT	18.9764	19.1280	19.3791	19.7157	19.9914	20.1554	20.1949	20.1922	20.1025	19.7767	19.3340	18.9544 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9764	19.1280	19.3791	19.7157	19.9914	20.1554	20.1949	20.1922	20.1025	19.7767	19.3340	18.9544 (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	0.9721	0.9605	0.9376	0.8844	0.7780	0.5994	0.4257	0.4670	0.7048	0.8907	0.9561	0.9758	(94)
Useful gains	574.9278	613.7545	631.0437	623.0371	562.8582	421.7894	286.1090	298.9480	431.8658	520.0391	540.9230	553.4075	(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	1229.2059	1188.3091	1072.6781	889.1152	679.9233	450.3306	291.4109	306.7354	488.7521	752.5274	1008.2446	1222.2799	(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	486.7829	386.1007	328.5760	191.5763	87.0964	0.0000	0.0000	0.0000	0.0000	172.9713	336.4716	497.6411	(98)
Space heating												2487.2164	(98)
Space heating per m2											(98) / (4) =	34.6120	(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													2742.2452	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	486.7829	386.1007	328.5760	191.5763	87.0964	0.0000	0.0000	0.0000	0.0000	172.9713	336.4716	497.6411	(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)	536.6956	425.6899	362.2669	211.2197	96.0269	0.0000	0.0000	0.0000	0.0000	190.7071	370.9720	548.6671	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	145.8445	109.2181	87.5296	46.7745	21.4558	7.5523	2.9002	29.6317	50.7686	92.1325	124.8879	145.1844	(64)	
Efficiency of water heater	89.8684	89.9043	89.9406	89.9912	89.9861	87.2000	87.2000	87.2000	87.2000	89.4522	89.7251	89.8852	(217)	
Fuel for water heating, kWh/month	162.2867	121.4826	97.3194	51.9768	23.8434	8.6609	3.3259	33.9813	58.2209	102.9963	139.1894	161.5220	(219)	
Water heating fuel used												964.8056	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2742.2452	(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)													334.3640	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.55 * 1080 * 1.00) =										-474.9908			-474.9908	(233)
Total delivered energy for all uses													3691.4239	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2742.2452	3.4800	95.4301 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	964.8056	3.4800	33.5752 (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	334.3640	13.1900	44.1026 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-474.9908	13.1900	-62.6513 (252)
Total energy cost			246.9442 (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] =	0.8875 (257)
SAP value		87.6190
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	2742.2452	0.2160	592.3250 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	964.8056	0.2160	208.3980 (264)
Space and water heating			800.7230 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	334.3640	0.5190	173.5349 (268)
Energy saving/generation technologies			
PV Unit	-474.9908	0.5190	-246.5202 (269)
Total kg/year			792.6126 (272)
CO2 emissions per m2			11.0300 (273)
EI value			90.9113
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	35.9300 (1b)	x 2.3900 (2b)	= 85.8727 (1b) - (3b)
First floor	35.9300 (1c)	x 2.6100 (2c)	= 93.7773 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.8600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 179.6500 (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) = 0.1670 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4170 (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) =	0.3544 (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	0.4519	0.4165	0.4076	0.3810	0.3810	0.3544	0.3544	0.3456	0.3544	0.3987	0.3899	0.4165 (22b)
Effective ac	0.6021	0.5867	0.5831	0.5726	0.5726	0.5628	0.5628	0.5597	0.5628	0.5795	0.5760	0.5867 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1500	1.1000	2.3650		(26)
Windows (Uw = 1.20)			10.9600	1.1450	12.5496		(27)
Ground Floor			35.9300	0.1200	4.3116	84.0000	3018.1200 (28a)
Brick and Block	69.7200	10.9300	58.7900	0.2400	14.1096	42.2200	2482.1138 (29a)
Tile Hung	12.1400	2.1800	9.9600	0.2400	2.3904	42.2200	420.5112 (29a)
Cold Party Wall	3.8100		3.8100	0.2600	0.9906	113.5000	432.4350 (29a)
Pitched Roof	35.9300		35.9300	0.1000	3.5930	9.1000	326.9630 (30)
Total net area of external elements Aum(A, m ²)			157.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.3098		(33)
Party Wall 1			42.3300	0.0000	0.0000	110.0000	4656.3000 (32)
Ground Floor Stud			58.9100			9.0000	530.1900 (32c)
First Floor Stud			60.4000			9.0000	543.6000 (32c)
Internal Floor 1			35.9300			18.0000	646.7400 (32d)
Internal Ceiling 1			35.9300			18.0000	646.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13703.7130 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							190.7002 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.7483 (36)
Total fabric heat loss						(33) + (36) =	48.0581 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.6960	34.7836	34.5672	33.9457	33.9457	33.3662	33.3662	33.1823	33.3662	34.3554	34.1482	34.7836 (38)
Heat transfer coeff	83.7541	82.8417	82.6253	82.0038	82.0038	81.4243	81.4243	81.2404	81.4243	82.4135	82.2063	82.8417 (39)
Average = Sum(39)m / 12 =												82.1836 (39)
HLP	1.1655	1.1528	1.1498	1.1412	1.1412	1.1331	1.1331	1.1305	1.1331	1.1469	1.1440	1.1528 (40)
HLP (average)												1.1437 (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												2.2904 (42)
Average daily hot water use (litres/day)												88.5975 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.4572	93.9133	90.3694	86.8255	83.2816	79.7377	79.7377	83.2816	86.8255	90.3694	93.9133	97.4572 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	144.5263	126.4036	130.4372	113.7183	109.1154	94.1583	87.2515	100.1224	101.3182	118.0766	128.8898	139.9660 (45)
Distribution loss (46)m = 0.15 x (45)m	21.6789	18.9605	19.5656	17.0577	16.3673	14.1237	13.0877	15.0184	15.1977	17.7115	19.3335	20.9949 (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	25.2941	22.8233	25.2320	24.3767	25.1591	24.3128	25.1016	25.1389	24.3476	25.2019	24.4369	25.2821 (61)
Total heat required for water heating calculated for each month	169.8204	149.2269	155.6692	138.0950	134.2746	118.4711	112.3531	125.2613	125.6658	143.2784	153.3267	165.2481 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1234.4649 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2073.9010 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.4878 (H8)
Utilisation factor												0.4894 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												88.5975 (H14)
Volume ratio Veff/V												0.8465 (H15)
Solar storage volume factor												0.9667 (H16)
Solar input												-862.7025 (H17)
Solar input	-28.3111	-40.4149	-68.4964	-93.4676	-110.3122	-117.3930	-113.0590	-100.8635	-79.8275	-54.6577	-33.2853	-22.6142 (63)
Solar input (sum of months) = Sum (63)m =												-862.7025 (63)
Output from w/h	141.5093	108.8120	87.1728	44.6274	23.9624	1.0781	0.0000	24.3978	45.8383	88.6207	120.0414	142.6338 (64)
Total per year (kWh/year) = Sum (64)m =												828.6939 (64)
Heat gains from water heating, kWh/month	54.3785	47.7350	49.6784	43.9055	42.5707	37.3858	35.2865	39.5754	39.7752	45.5609	48.9651	52.8592 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253	137.4253 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	47.3327	42.0405	34.1896	25.8837	19.3484	16.3347	17.6502	22.9425	30.7933	39.0992	45.6345	48.6482 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	300.8935	304.0158	296.1477	279.3972	258.2528	238.3801	225.1039	221.9815	229.8497	246.6001	267.7445	287.6173 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329	51.0329 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168	-91.6168 (71)
Water heating gains (Table 5)	73.0894	71.0343	66.7720	60.9799	57.2186	51.9248	47.4281	53.1928	55.2433	61.2378	68.0071	71.0473 (72)
Total internal gains	521.1569	516.9319	496.9506	466.1022	434.6612	406.4810	390.0236	397.9581	415.7277	446.7785	481.2275	507.1542 (73)

6. Solar gains

[Jan]												Gains
				Area	Solar flux		g	FF		Access		W
				m2	Table 6a		Specific data	Specific data		factor		
					W/m2		or Table 6b	or Table 6c		Table 6d		
North				7.8200	13.8645		0.6300	0.7000		0.7700		33.1348
South				3.1400	58.2505		0.6300	0.7000		0.7700		55.8986 (74)
Solar gains	89.0334	132.6926	192.1968	267.7344	311.8101	347.9059	322.0980	281.2921	228.9646	158.0818	106.2174	72.4659 (83)
Total gains	610.1904	649.6245	689.1474	733.8366	746.4713	754.3869	712.1216	679.2502	644.6924	604.8603	587.4449	579.6201 (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	45.4496	45.9501	46.0705	46.4196	46.4196	46.7500	46.7500	46.8558	46.7500	46.1889	46.3053	45.9501
alpha	4.0300	4.0633	4.0714	4.0946	4.0946	4.1167	4.1167	4.1237	4.1167	4.0793	4.0870	4.0633
util living area	0.9747	0.9666	0.9436	0.8874	0.7702	0.5719	0.4159	0.4338	0.6805	0.8821	0.9549	0.9779 (86)
MIT	19.8589	19.9719	20.2251	20.5429	20.8164	20.9603	20.9918	20.9905	20.9195	20.6384	20.2351	19.8471 (87)
Th 2	19.9477	19.9579	19.9604	19.9674	19.9674	19.9739	19.9739	19.9739	19.9739	19.9627	19.9651	19.9579 (88)
util rest of house	0.9683	0.9583	0.9291	0.8580	0.7110	0.4796	0.3041	0.3181	0.5902	0.8433	0.9415	0.9723 (89)
MIT 2	18.9416	19.0600	19.3076	19.6119	19.8490	19.9568	19.9720	19.9738	19.9344	19.7010	19.3246	18.9385 (90)
Living area fraction									fLA = Living area / (4) =			0.2217 (91)
MIT	19.1450	19.2621	19.5110	19.8183	20.0634	20.1792	20.1981	20.1992	20.1528	19.9088	19.5265	19.1399 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1450	19.2621	19.5110	19.8183	20.0634	20.1792	20.1981	20.1992	20.1528	19.9088	19.5265	19.1399 (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	0.9620	0.9514	0.9215	0.8531	0.7170	0.4989	0.3290	0.3439	0.6072	0.8410	0.9345	0.9665	(94)
Useful gains	587.0314	618.0727	635.0514	626.0366	535.2155	376.3655	234.2967	233.5699	391.4413	508.6793	548.9964	560.2237	(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	1151.1997	1123.5101	1008.9357	837.9380	612.0307	389.1467	235.9749	235.5296	419.5598	668.2738	914.6649	1129.9513	(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	419.7412	339.6540	278.1699	152.5690	57.1505	0.0000	0.0000	0.0000	0.0000	118.7383	263.2814	423.8774	(98)
Space heating												2053.1817	(98)
Space heating per m2												(98) / (4) =	28.5720 (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													2263.7064 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	419.7412	339.6540	278.1699	152.5690	57.1505	0.0000	0.0000	0.0000	0.0000	118.7383	263.2814	423.8774	(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)	462.7797	374.4807	306.6923	168.2128	63.0105	0.0000	0.0000	0.0000	0.0000	130.9132	290.2771	467.3400	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	141.5093	108.8120	87.1728	44.6274	23.9624	1.0781	0.0000	24.3978	45.8383	88.6207	120.0414	142.6338	(64)
Efficiency of water heater	89.7913	89.8252	89.8396	89.8835	89.6371	87.2000	87.2000	87.2000	87.2000	89.1704	89.5741	89.7926	(217)
Fuel for water heating, kWh/month	157.5979	121.1374	97.0316	49.6502	26.7326	1.2364	0.0000	27.9792	52.5668	99.3836	134.0135	158.8481	(219)
Water heating fuel used												926.1774	(219)
Annual totals kWh/year													
Space heating fuel - main system												2263.7064	(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)													334.3640 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.55 * 1234 * 1.00) =									-543.1645			-543.1645	(233)
Total delivered energy for all uses												3106.0833	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2263.7064	10.2300	231.5772 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	926.1774	10.2300	94.7479 (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	334.3640	36.7200	122.7784 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-543.1645	36.7200	-199.4500 (252)
Total energy cost			398.5535 (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	2263.7064	0.2160	488.9606 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	926.1774	0.2160	200.0543 (264)
Space and water heating			689.0149 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	334.3640	0.5190	173.5349 (268)
Energy saving/generation technologies			
PV Unit	-543.1645	0.5190	-281.9024 (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

645.5224 (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	2263.7064	1.2200	2761.7218 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	926.1774	1.2200	1129.9364 (264)
Space and water heating			3891.6583 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	334.3640	3.0700	1026.4974 (268)
Energy saving/generation technologies			
PV Unit	-543.1645	3.0700	-1667.5152 (269)
Primary energy kWh/year			3634.3905 (272)
Primary energy kWh/m2/year			50.5760 (273)

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 26	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Bv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	86 B	DER	15.55	TER	19.53
Environmental	89 B	% DER<TER	20.36		
CO ₂ Emissions (t/year)	0.83	DFEE	46.32	TFEE	54.65
General Requirements Compliance	Pass	% DFEE<TFEE	15.23		

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

SAP Rating	86 B	DER	15.55	TER	19.53
Environmental	89 B	% DER<TER	20.36		
CO ₂ Emissions (t/year)	0.83	DFEE	46.32	TFEE	54.65
General Requirements Compliance	Pass	% DFEE<TFEE	15.23		

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

SAP Rating	86 B	DER	15.55	TER	19.53
Environmental	89 B	% DER<TER	20.36		
CO ₂ Emissions (t/year)	0.83	DFEE	46.32	TFEE	54.65
General Requirements Compliance	Pass	% DFEE<TFEE	15.23		

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

Building Elements

Wall Tile Hung

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)	Density (kg/m ³)	Heat Cap. (J/kgK)
Ext surface				0.1300			
Layer 1	Tiling						
	Main construction	30	1.5000	0.0000	100.00		
Layer 2	Standard cavity						
	Main construction	25	0.0000	0.0000	90.50		
	Main construction	25	0.1300	0.0000	9.50		
	Corrections - Cavity Ventilated, Emissivity: Normal						
Layer 3	Blockwork, dense						
	Main construction	100	1.5900	0.0629	92.97		
	Main construction	100	0.8800	0.1136	7.03		
Layer 4	Supafil 34						
	Main construction	100	0.0340	2.9412	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 5	Supabloc						
	Main construction	100	0.1100	0.9091	94.04	460	1000
	Main construction	100	0.8803	0.1136	5.96	460	1000
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 6	airspace/plaster dabs						
	Main construction	15	0.0882	0.1700	80.00		
	Main construction	15	0.0882	0.1700	20.00		
	Corrections - Cavity Unventilated, Emissivity: Normal						
Layer 7	Plasterboard, standard						
	Main construction	12.5	0.2100	0.0595	100.00	700	1000
Int surface				0.1300			

Total resistance: Upper limit = 4.349 m² K/W Lower limit = 4.137 m² K/W Average = 4.243 m² K/W
Total correction = 0.0002 m² K/W U-value (unrounded) = 0.24 W/m² 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 26	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Bv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	86 B	DER	15.55	TER	19.53
Environmental	89 B	% DER<TER	20.36		
CO ₂ Emissions (t/year)	0.83	DFEE	46.32	TFEE	54.65
General Requirements Compliance	Pass	% DFEE<TFEE	15.23		

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 000004

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	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04		
	Main construction	100	0.8803	0.1136	5.96		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	Supafil Party Wall						
	Main construction	100	0.0400	2.5000	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 3	Supabloc *7						
	Main construction	100	0.1900	0.5263	94.04	1450	1000
	Main construction	100	0.8803	0.1136	5.96	1450	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 = 3.898 m ² K/W	Lower limit = 3.765 m ² K/W	Average = 3.831 m ² K/W
	Total correction = 0.0045 m ² K/W	U-value (unrounded) = 0.26 W/m ² K	

Unheated space: None		
Total thickness: 328 mm	U-value: 0.26 W/m² K	Kappa: 113.50 kJ/m² K

U-VALUE CALCULATOR REPORT

Property Reference	SAP 0906 Plot 26	Issued on Date	29/11/2023
Assessment Reference	Rev B	Prop Type Ref	Block Bv
Project			
Calculation Type	New Build (As Designed)		

SAP Rating	86 B	DER	15.55	TER	19.53
Environmental	89 B	% DER<TER	20.36		
CO ₂ Emissions (t/year)	0.83	DFEE	46.32	TFEE	54.65
General Requirements Compliance	Pass	% DFEE<TFEE	15.23		

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

SAP Rating	86 B	DER	15.55	TER	19.53
Environmental	89 B	% DER<TER	20.36		
CO ₂ Emissions (t/year)	0.83	DFEE	46.32	TFEE	54.65
General Requirements Compliance	Pass	% DFEE<TFEE	15.23		

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

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	16.95 m	35.93 m ²	2.39 m
	1st Storey:	8.58 m	35.93 m ²	2.61 m

7.0 Living Area	15.93	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	190.7	kJ/m ² K

9.0 External Walls							
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)	
Brick and Block	Cavity Wall	Other	0.24	42.22	69.72	58.79	
Tile Hung	Cavity Wall	Other	0.24	42.22	12.14	9.96	
Cold Party Wall	Cavity Wall	Other	0.26	113.50	3.81	3.81	

9.1 Party Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)	
Party Wall 1	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	42.33	

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Ground Floor Stud	Plasterboard on timber frame		9.00	58.91
First Floor Stud	Plasterboard on timber frame		9.00	60.40

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Pitched Roof	External Plane Roof	Other	0.10	9.10	35.93	35.93

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling 1	Plasterboard ceiling, carpeted chipboard floor	9.00	35.93

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Other	0.12	84.00	35.93

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor 1	Plasterboard ceiling, carpeted chipboard floor	18.00	35.93

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] Brick and Block	South							2.15	
Front Elevation	Window	[1] Brick and Block	South	None	0.00					0.96	
Rear Elevation	Window	[1] Brick and Block	North	None	0.00					7.82	
Front Tiled	Window	[2] Tile Hung	South	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)	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	6.47	0.021	No	Knauf P5
Independently assessed	E4 Jamb	22.50	0.016	No	Knauf P6
Table K1 - Approved	E5 Ground floor (normal)	16.95	0.160	No	
Independently assessed	E6 Intermediate floor within a dwelling	8.58	0.000	No	CD0029
Independently assessed	E10 Eaves (insulation at ceiling level)	8.58	0.071	No	Knauf P16
Independently assessed	E12 Gable (insulation at ceiling level)	8.50	0.044	No	Knauf P21
Independently assessed	E16 Corner (normal)	0.90	0.039	No	Knauf P23
Independently assessed	E18 Party wall between dwellings	10.00	0.036	No	Knauf P25 Halved
Table K1 - Default	P1 Party wall - Ground floor	8.50	0.160	No	
Table K1 - Default	P6 Party wall - Ground floor (inverted)	8.50	0.070	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	17.00	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	17.00	0.035	No	Knauf P29 Halved

Y-value 0.049 W/m²K

18.0 Pressure Testing

Yes

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

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

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

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

External

External lights fitted	Yes
Light and motion sensor	Yes

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

Description	Database	
Percentage of Heat	Mains Gas Combi	%
Database Ref. No.	100	
Fuel Type	17513	
Main Heating	Mains gas	
SAP Code	BGW	
In Winter	104	
In Summer	90.7	
Controls	87.2	
PCDF Controls	CBE Programmer, room thermostat and TRVs	
Delayed Start Stat	0	
Sap Code	No	
Flue Type	2106	
Fan Assisted Flue	Balanced	
Is MHS Pumped	Yes	
Heat Emitter	Pump in heated space	
Flow Temperature	Radiators	
Combi boiler type	Normal (> 45°C)	
	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
0.55	South	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£82	B 88	