

# PREDICTED ENERGY ASSESSMENT

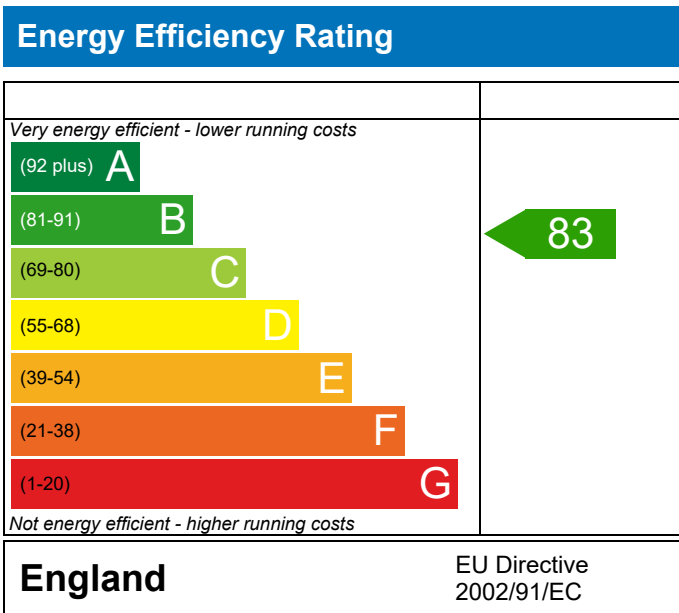


134 - PRJ011855

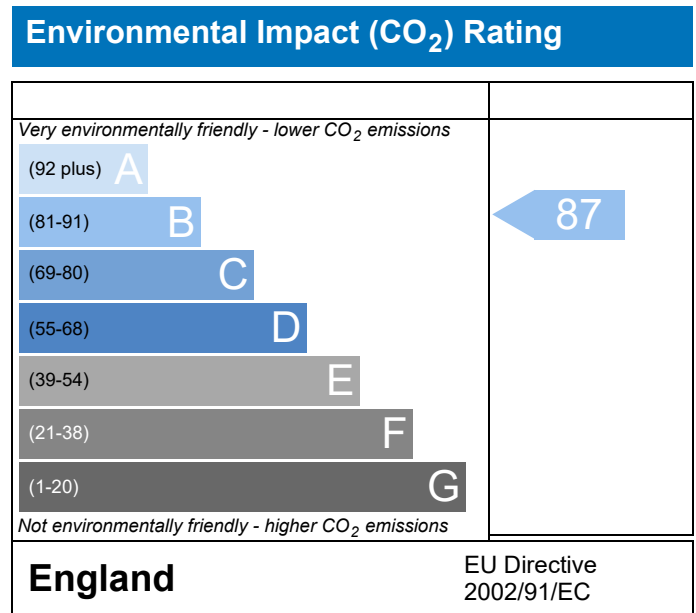
Dwelling type: House, End-Terrace  
 Date of assessment: 02/08/2021  
 Produced by: Michael Juckes  
 Total floor area: 68.06 m<sup>2</sup>

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 (CO<sub>2</sub>) emissions.



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.



The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO<sub>2</sub>) emissions. The higher the rating the less impact it has on the environment.

*This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.*

# BUILDING REGULATION COMPLIANCE

## Calculation Type: New Build (As Designed)



Property Reference	134 - PRJ011855		Issued on Date	02/08/2021	
Assessment Reference	134 E	Prop Type Ref	BLO-0283 SIN BR-ET 4.1		
Property	134 - PRJ011855				
SAP Rating	83 B	DER	17.99	TER	19.06
Environmental	87 B	% DER<TER	5.60		
CO <sub>2</sub> Emissions (t/year)	1.06	DFEE	43.64	TFEE	51.68
General Requirements Compliance	Pass	% DFEE<TFEE	15.55		
Assessor Details	Mr. Michael Juckes, Michael Juckes, Tel: 02033971373, michael@briaryenergy.co.uk			Assessor ID	T850-0001
Client					

### 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)	19.06	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	17.99	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-1.07 (-5.6%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.68	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.64	kWh/m <sup>2</sup> /yr	
	-8.1 (-15.7%)	kWh/m <sup>2</sup> /yr	Pass

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.27 (max. 2.00)	1.30 (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	5.01 (design value)	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa	
Maximum	10.0	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 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  
Ideal LOGIC COMBI ESP1 30  
Combi boiler  
Efficiency: 89.6% 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 (East Anglia)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

3.44 m<sup>2</sup>, No overhang

Windows facing South East

4.50 m<sup>2</sup>, No overhang

Windows facing South West

3.36 m<sup>2</sup>, No overhang

Air change rate

4.21 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

## Criterion 4 – Building performance consistent with DER and DFEE rate

### Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00 W/m<sup>2</sup>K

Pass

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

5.01 (design value) m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

Maximum

10.0 m<sup>3</sup>/(h.m<sup>2</sup>) @ 50 Pa

Pass

### 10 Key features

Party wall U-value

0.00 W/m<sup>2</sup>K

Roof U-value

0.10 W/m<sup>2</sup>K

Thermal bridging y-value

0.030 W/m<sup>2</sup>K

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



Property Reference	134 - PRJ011855	Issued on Date	02/08/2021
Assessment Reference	134 E	Prop Type Ref	BLO-0283 SIN BR-ET 4.1
Property	134 - PRJ011855		

SAP Rating	83 B	DER	17.99	TER	19.06
Environmental	87 B	% DER<TER	5.60		
CO <sub>2</sub> Emissions (t/year)	1.06	DFEE	43.64	TTEE	51.68
General Requirements Compliance	Pass	% DFEE<TTEE	15.55		

Assessor Details	Mr. Michael Juckes, Michael Juckes, Tel: 02033971373, michael@briaryenergy.co.uk	Assessor ID	T850-0001
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Client	
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### 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	34.0300 (1b)	x 2.3300 (2b)	= 79.2899 (1b) - (3b)
First floor	34.0300 (1c)	x 2.5300 (2c)	= 86.0959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.3858 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30.0000 / (5) =	0.1814 (8)							
Pressure test				Yes								
Measured/design AP50					5.0100							
Infiltration rate					0.4319 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3995 (21)							
Wind speed	Jan 4.9000	Feb 4.8000	Mar 4.7000	Apr 4.2000	May 4.2000	Jun 3.7000	Jul 3.8000	Aug 3.8000	Sep 4.0000	Oct 4.2000	Nov 4.3000	Dec 4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infiltr rate	0.4894	0.4794	0.4694	0.4195	0.4195	0.3695	0.3795	0.3795	0.3995	0.4195	0.4295	0.4494 (22b)
Effective ac	0.6198	0.6149	0.6102	0.5880	0.5880	0.5683	0.5720	0.5720	0.5798	0.5880	0.5922	0.6010 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows (Uw = 1.30)			11.3000	1.2357	13.9639		(27)
Solid Door			4.0600	1.2000	4.8720		(26)
Flr - Ground			34.0330	0.2200	7.4873	75.6000	2572.8948 (28a)
Wl - Brick	80.2040	15.3580	64.8460	0.2400	15.5630	38.9400	2525.1032 (29a)
Rf - Ins Joist	34.0330		34.0330	0.1000	3.4033	5.8200	198.0721 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			148.2720				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2895		(33)
Party Wall			39.3810	0.0000	0.0000	54.0300	2127.7554 (32)
Ground Floor Stud			49.6275			5.8200	288.8323 (32c)
1st Floor Stud			80.0085			5.8200	465.6496 (32c)
Internal Floor			34.0400			18.0000	612.7200 (32d)
Internal Ceiling			34.0400			5.8200	198.1128 (32e)
Heat capacity Cm = Sum (A x k)					(28)...(30) + (32) + (32a)...(32e) =		8989.1402 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							132.0767 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3881 (36)
Total fabric heat loss					(33) + (36) =		49.6776 (37)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF HEAT DEMAND 09 Jan 2014

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	33.8244	33.5603	33.3017	32.0904	32.0904	31.0152	31.2193	31.2193	31.6440	32.0904	32.3218	32.8009 (38)
Average = Sum(39)m / 12 =	83.5020	83.2379	82.9793	81.7680	81.7680	80.6928	80.8969	80.8969	81.3216	81.7680	81.9994	82.4785 (39)
												81.9424 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2269	1.2230	1.2192	1.2014	1.2014	1.1856	1.1886	1.1886	1.1949	1.2014	1.2048	1.2118 (40)
Days in month												1.2040 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

Assumed occupancy													2.1981 (42)
Average daily hot water use (litres/day)													86.4053 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Energy conte	95.0459	91.5897	88.1335	84.6772	81.2210	77.7648	77.7648	81.2210	84.6772	88.1335	91.5897	95.0459 (44)	
Energy content (annual)	140.9503	123.2760	127.2098	110.9046	106.4156	91.8286	85.0927	97.6451	98.8113	115.1550	125.7007	136.5028 (45)	
Distribution loss (46)m = 0.15 x (45)m	21.1425	18.4914	19.0815	16.6357	15.9623	13.7743	12.7639	14.6468	14.8217	17.2733	18.8551	20.4754 (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													
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)	
Total heat required for water heating calculated for each month	14.6188	13.1798	14.5533	14.0400	14.4762	13.9725	14.4154	14.4548	14.0093	14.5214	14.1037	14.6061 (61)	
Solar input	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090 (62)	
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)	
	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090 (64)	
RHI water heating demand												1530.4439 (64)	
Heat gains from water heating, kWh/month												1530 (64)	
	50.5207	44.2842	45.9356	40.3858	39.0022	34.0261	31.8972	36.0807	36.3571	41.9194	45.3214	49.0387 (65)	

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	44.4959	39.5209	32.1406	24.3325	18.1888	15.3558	16.5924	21.5675	28.9478	36.7559	42.8996	45.7326 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	287.6530	290.6380	283.1160	267.1027	246.8887	227.8904	215.1984	212.2135	219.7354	235.7488	255.9627	274.9610 (68)
Pumps, fans	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868 (69)
Losses e.g. evaporation (negative values) (Table 5)	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Water heating gains (Table 5)	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248 (71)
Total internal gains	67.9041	65.8992	61.7414	56.0914	52.4224	47.2585	42.8725	48.4956	50.4959	56.3433	62.9464	65.9123 (72)
	497.4023	493.4072	474.3472	444.8757	414.8491	387.8539	372.0126	379.6258	396.5284	426.1972	459.1579	483.9551 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Access factor Table 6d	Gains W						
Northeast	3.4380	12.9465	0.4700	0.0000	0.7700	16.1082 (75)						
Southeast	4.5000	40.9830	0.4700	0.0000	0.7700	66.7429 (77)						
Southwest	3.3610	40.9830	0.4700	0.0000	0.7700	49.8495 (79)						
Solar gains	132.7007	215.6536	303.2470	418.4236	473.1122	499.0238	472.4453	420.8820	356.0400	252.8383	163.8297	111.8479 (83)
Total gains	630.1030	709.0608	777.5941	863.2994	887.9613	886.8778	844.4579	800.5077	752.5684	679.0355	622.9876	595.8030 (84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	29.9033	29.9981	30.0916	30.5374	30.5374	30.9443	30.8662	30.8662	30.7051	30.5374	30.4512	30.2744	
util living area	2.9936	2.9999	3.0061	3.0358	3.0358	3.0630	3.0577	3.0577	3.0470	3.0358	3.0301	3.0183	
	0.9439	0.9211	0.8763	0.7834	0.6540	0.4756	0.3185	0.3349	0.5747	0.8038	0.9122	0.9504 (86)	
MIT	19.3505	19.5735	19.9640	20.4275	20.7522	20.9346	20.9868	20.9848	20.8796	20.4815	19.8688	19.3179 (87)	
Th 2	19.8986	19.9016	19.9047	19.9189	19.9189	19.9315	19.9291	19.9291	19.9241	19.9189	19.9162	19.9105 (88)	
util rest of house	0.9341	0.9078	0.8551	0.7472	0.5965	0.3958	0.2214	0.2332	0.4926	0.7617	0.8948	0.9416 (89)	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF HEAT DEMAND 09 Jan 2014

MIT 2	18.4338	18.6518	19.0292	19.4704	19.7519	19.8996	19.9259	19.9254	19.8596	19.5301	18.9539	18.4114 (90)
Living area fraction									fLA = Living area / (4) =			0.2148 (91)
MIT	18.6307	18.8498	19.2300	19.6760	19.9668	20.1219	20.1538	20.1529	20.0787	19.7344	19.1505	18.6061 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4807	18.6998	19.0800	19.5260	19.8168	19.9719	20.0038	20.0029	19.9287	19.5844	19.0005	18.4561 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9180	0.8898	0.8363	0.7324	0.5906	0.3989	0.2283	0.2404	0.4930	0.7467	0.8767	0.9265 (94)
Useful gains	578.4549	630.9334	650.2833	632.3227	524.4110	353.8196	192.7739	192.4416	371.0055	507.0489	546.1804	552.0215 (95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Heat loss rate W												
Month fracti	1150.7160	1123.6922	1002.3902	819.8053	598.2800	368.9233	194.4573	194.3901	400.8095	669.2255	926.6302	1134.5831 (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												
Space heating	425.7622	331.1339	261.9676	134.9874	54.9585	0.0000	0.0000	0.0000	0.0000	120.6594	273.9239	433.4259 (98)
RHI space heating demand												2036.8188 (98)
												2037 (98)

# 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	34.0300 (1b)	x 2.3300 (2b)	= 79.2899 (1b) - (3b)
First floor	34.0300 (1c)	x 2.5300 (2c)	= 86.0959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.3858 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1814 (8)							
Pressure test				Yes								
Measured/design AP50					5.0100							
Infiltration rate					0.4319 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3995 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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												
Effective ac	0.5094	0.4994	0.4894	0.4395	0.4295	0.3795	0.3795	0.3695	0.3995	0.4295	0.4494	0.4694 (22b)
	0.6297	0.6247	0.6198	0.5966	0.5922	0.5720	0.5720	0.5683	0.5798	0.5922	0.6010	0.6102 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.30)			11.3000	1.2357	13.9639		(27)					
Solid Door			4.0600	1.2000	4.8720		(26)					
Flr - Ground			34.0330	0.2200	7.4873	75.6000	2572.8948 (28a)					
Wl - Brick	80.2040	15.3580	64.8460	0.2400	15.5630	38.9400	2525.1032 (29a)					
RF - Ins Joist	34.0330		34.0330	0.1000	3.4033	5.8200	198.0721 (30)					
Total net area of external elements Aum(A, m2)			148.2720				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2895		(33)					
Party Wall			39.3810	0.0000	0.0000	54.0300	2127.7554 (32)					
Ground Floor Stud			49.6275			5.8200	288.8323 (32c)					
1st Floor Stud			80.0085			5.8200	465.6496 (32c)					
Internal Floor			34.0400			18.0000	612.7200 (32d)					
Internal Ceiling			34.0400			5.8200	198.1128 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8989.1402 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							132.0767 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3881 (36)					
Total fabric heat loss						(33) + (36) =	49.6776 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.3688	Feb 34.0938	Mar 33.8244	Apr 32.5586	May 32.3218	Jun 31.2193	Jul 31.2193	Aug 31.0152	Sep 31.6440	Oct 32.3218	Nov 32.8009	Dec 33.3017 (38)
Heat transfer coeff	84.0464	83.7715	83.5020	82.2362	81.9994	80.8969	80.8969	80.6928	81.3216	81.9994	82.4785	82.9793 (39)
Average = Sum(39)m / 12 =												82.2351 (39)
HLP	Jan 1.2349	Feb 1.2308	Mar 1.2269	Apr 1.2083	May 1.2048	Jun 1.1886	Jul 1.1886	Aug 1.1856	Sep 1.1949	Oct 1.2048	Nov 1.2118	Dec 1.2192 (40)
HLP (average)												1.2083 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1981 (42)
Average daily hot water use (litres/day)												86.4053 (43)
Daily hot water use	95.0459	91.5897	88.1335	84.6772	81.2210	77.7648	77.7648	81.2210	84.6772	88.1335	91.5897	95.0459 (44)
Energy conte	140.9503	123.2760	127.2098	110.9046	106.4156	91.8286	85.0927	97.6451	98.8113	115.1550	125.7007	136.5028 (45)
Energy content (annual)										Total = Sum(45)m =		1359.4925 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.1425	18.4914	19.0815	16.6357	15.9623	13.7743	12.7639	14.6468	14.8217	17.2733	18.8551	20.4754 (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	14.6188	13.1798	14.5533	14.0400	14.4762	13.9725	14.4154	14.4548	14.0093	14.5214	14.1037	14.6061 (61)
Total heat required for water heating calculated for each month	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090 (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	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090 (64)
Heat gains from water heating, kWh/month	50.5207	44.2842	45.9356	40.3858	39.0022	34.0261	31.8972	36.0807	36.3571	41.9194	45.3214	49.0387 (65)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)	
Total per year (kWh/year) = Sum(64)m =											1530.4439 (64)	

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.4959	39.5209	32.1406	24.3325	18.1888	15.3558	16.5924	21.5675	28.9478	36.7559	42.8996	45.7326 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.6530	290.6380	283.1160	267.1027	246.8887	227.8904	215.1984	212.2135	219.7354	235.7488	255.9627	274.9610 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868 (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)	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248 (71)
Water heating gains (Table 5)	67.9041	65.8992	61.7414	56.0914	52.4224	47.2585	42.8725	48.4956	50.4959	56.3433	62.9464	65.9123 (72)
Total internal gains	497.4023	493.4072	474.3472	444.8757	414.8491	387.8539	372.0126	379.6258	396.5284	426.1972	459.1579	483.9551 (73)

#### 6. Solar gains

[Jan]	Area m <sup>2</sup>	Solar flux Table 6a W/m <sup>2</sup>	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	3.4380	11.2829	0.4700	0.0000	0.7700	14.0384 (75)						
Southeast	4.5000	36.7938	0.4700	0.0000	0.7700	59.9206 (77)						
Southwest	3.3610	36.7938	0.4700	0.0000	0.7700	44.7540 (79)						
Solar gains	118.7130	206.8751	295.4413	386.8264	452.2269	457.2917	437.4093	387.3434	326.8882	231.9806	143.0400	101.0441 (83)
Total gains	616.1153	700.2824	769.7885	831.7022	867.0760	845.1457	809.4220	766.9691	723.4166	658.1778	602.1979	584.9992 (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	29.7096	29.8071	29.9033	30.3636	30.4512	30.8662	30.8662	30.9443	30.7051	30.4512	30.2744	30.0916	
alpha	2.9806	2.9871	2.9936	3.0242	3.0301	3.0577	3.0577	3.0630	3.0470	3.0301	3.0183	3.0061	
util living area	0.9499	0.9268	0.8877	0.8143	0.7017	0.5512	0.4190	0.4554	0.6507	0.8393	0.9265	0.9560 (86)	
MIT	19.2427	19.4956	19.8648	20.3124	20.6661	20.8870	20.9635	20.9523	20.8037	20.3494	19.7278	19.1993 (87)	
Th 2	19.8922	19.8954	19.8986	19.9134	19.9162	19.9291	19.9291	19.9315	19.9241	19.9162	19.9105	19.9047 (88)	
util rest of house	0.9412	0.9144	0.8686	0.7826	0.6506	0.4760	0.3250	0.3601	0.5789	0.8048	0.9120	0.9483 (89)	
MIT 2	18.3233	18.5714	18.9297	19.3619	19.6788	19.8664	19.9154	19.9124	19.8049	19.4088	18.8138	18.2903 (90)	
Living area fraction	fLA = Living area / (4) =												0.2148 (91)
MIT	18.5208	18.7699	19.1306	19.5661	19.8909	20.0856	20.1406	20.1358	20.0195	19.6109	19.0101	18.4856 (92)	
Temperature adjustment													-0.1500
adjusted MIT	18.3708	18.6199	18.9806	19.4161	19.7409	19.9356	19.9906	19.9858	19.8695	19.4609	18.8601	18.3356 (93)	

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9259	0.8967	0.8496	0.7660	0.6416	0.4765	0.3306	0.3652	0.5749	0.7877	0.8945	0.9340 (94)	
Useful gains	570.4442	627.9701	654.0203	637.0610	556.2785	402.6760	267.5755	280.0706	415.8619	518.4524	538.6765	546.3974 (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	1182.5993	1149.3398	1042.1512	864.8049	659.3476	431.6339	274.2876	289.3463	469.1829	726.5854	969.9570	1172.9595 (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	455.4434	350.3605	288.7694	163.9756	76.6834	0.0000	0.0000	0.0000	0.0000	154.8509	310.5220	466.1622 (98)	
Space heating													2266.7673 (98)
Space heating per m <sup>2</sup>													(98) / (4) = 33.3054 (99)

#### 8c. Space cooling requirement



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2504.7152 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	455.4434	350.3605	288.7694	163.9756	76.6834	0.0000	0.0000	0.0000	0.0000	154.8509	310.5220	466.1622	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	503.2524	387.1386	319.0822	181.1885	84.7330	0.0000	0.0000	0.0000	0.0000	171.1060	343.1182	515.0963	(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	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090	(64)
Efficiency of water heater (217)m	89.6632	89.5796	89.4207	89.0878	88.5147	87.3000	87.3000	87.3000	87.3000	89.0129	89.4817	87.3000	(216)
Fuel for water heating, kWh/month	173.5039	152.3291	158.5349	140.2489	136.5782	121.1926	113.9841	128.4077	129.2332	145.6826	156.2379	168.4695	(219)
Water heating fuel used													1724.4025 (219)
Annual totals kWh/year													
Space heating fuel - main system													2504.7152 (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)													314.3249 (232)
Total delivered energy for all uses													4618.4426 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2504.7152	3.4800	87.1641 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1724.4025	3.4800	60.0092 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	314.3249	13.1900	41.4595 (250)
Additional standing charges			120.0000 (251)
Total energy cost			318.5252 (255)

#### 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.1833 (257)
SAP value		83.4934
SAP rating (Section 12)		83 (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	2504.7152	0.2160	541.0185 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1724.4025	0.2160	372.4709 (264)
Space and water heating			913.4894 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	314.3249	0.5190	163.1346 (268)
Total kg/year			1115.5490 (272)
CO2 emissions per m2			16.3900 (273)
EI value			86.7784
EI rating			87 (274)
EI band			B

#### Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$ , stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$ , stars = 4
Water heating energy efficiency	$3.48 / 0.8864 = 3.926$ , stars = 4
Water heating environmental impact	$0.216 / 0.8864 = 0.2437$ , stars = 4

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

# 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 <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	34.0300 (1b)	x 2.3300 (2b)	= 79.2899 (1b) - (3b)
First floor	34.0300 (1c)	x 2.5300 (2c)	= 86.0959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.3858 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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) = 0.1814 (8)							
Pressure test					Yes							
Measured/design AP50					5.0100							
Infiltration rate					0.4319 (18)							
Number of sides sheltered					1 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3995 (21)							
Wind speed	Jan 4.9000	Feb 4.8000	Mar 4.7000	Apr 4.2000	May 4.2000	Jun 3.7000	Jul 3.8000	Aug 3.8000	Sep 4.0000	Oct 4.2000	Nov 4.3000	Dec 4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate												
Effective ac	0.4894	0.4794	0.4694	0.4195	0.4195	0.3695	0.3795	0.3795	0.3995	0.4195	0.4295	0.4494 (22b)
	0.6198	0.6149	0.6102	0.5880	0.5880	0.5683	0.5720	0.5720	0.5798	0.5880	0.5922	0.6010 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K
Windows (Uw = 1.30)			11.3000	1.2357	13.9639		(27)
Solid Door			4.0600	1.2000	4.8720		(26)
Flr - Ground			34.0330	0.2200	7.4873	75.6000	2572.8948 (28a)
Wl - Brick	80.2040	15.3580	64.8460	0.2400	15.5630	38.9400	2525.1032 (29a)
RF - Ins Joist	34.0330		34.0330	0.1000	3.4033	5.8200	198.0721 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			148.2720				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2895		(33)
Party Wall			39.3810	0.0000	0.0000	54.0300	2127.7554 (32)
Ground Floor Stud			49.6275			5.8200	288.8323 (32c)
1st Floor Stud			80.0085			5.8200	465.6496 (32c)
Internal Floor			34.0400			18.0000	612.7200 (32d)
Internal Ceiling			34.0400			5.8200	198.1128 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8989.1402 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							132.0767 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3881 (36)
Total fabric heat loss						(33) + (36) =	49.6776 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	33.8244	33.5603	33.3017	32.0904	32.0904	31.0152	31.2193	31.2193	31.6440	32.0904	32.3218	32.8009 (38)
Average = Sum(39)m / 12 =	83.5020	83.2379	82.9793	81.7680	81.7680	80.6928	80.8969	80.8969	81.3216	81.7680	81.9994	82.4785 (39)
HLP	1.2269	1.2230	1.2192	1.2014	1.2014	1.1856	1.1886	1.1886	1.1949	1.2014	1.2048	1.2118 (40)
HLP (average)												1.2040 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1981 (42)
Average daily hot water use (litres/day)												86.4053 (43)
Daily hot water use	95.0459	91.5897	88.1335	84.6772	81.2210	77.7648	77.7648	81.2210	84.6772	88.1335	91.5897	95.0459 (44)
Energy conte	140.9503	123.2760	127.2098	110.9046	106.4156	91.8286	85.0927	97.6451	98.8113	115.1550	125.7007	136.5028 (45)
Energy content (annual)										Total = Sum(45)m =		1359.4925 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

Distribution loss (46)m = 0.15 x (45)m	21.1425	18.4914	19.0815	16.6357	15.9623	13.7743	12.7639	14.6468	14.8217	17.2733	18.8551	20.4754 (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	14.6188	13.1798	14.5533	14.0400	14.4762	13.9725	14.4154	14.4548	14.0093	14.5214	14.1037	14.6061 (61)
Total heat required for water heating calculated for each month	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090 (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	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090 (64)
Heat gains from water heating, kWh/month	50.5207	44.2842	45.9356	40.3858	39.0022	34.0261	31.8972	36.0807	36.3571	41.9194	45.3214	49.0387 (65)
										Solar input (sum of months) = Sum(63)m =		0.0000 (63)
										Total per year (kWh/year) = Sum(64)m =		1530.4439 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.4959	39.5209	32.1406	24.3325	18.1888	15.3558	16.5924	21.5675	28.9478	36.7559	42.8996	45.7326 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.6530	290.6380	283.1160	267.1027	246.8887	227.8904	215.1984	212.2135	219.7354	235.7488	255.9627	274.9610 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868 (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)	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248 (71)
Water heating gains (Table 5)	67.9041	65.8992	61.7414	56.0914	52.4224	47.2585	42.8725	48.4956	50.4959	56.3433	62.9464	65.9123 (72)
Total internal gains	497.4023	493.4072	474.3472	444.8757	414.8491	387.8539	372.0126	379.6258	396.5284	426.1972	459.1579	483.9551 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	3.4380	12.9465	0.4700	0.0000	0.7700	16.1082 (75)						
Southeast	4.5000	40.9830	0.4700	0.0000	0.7700	66.7429 (77)						
Southwest	3.3610	40.9830	0.4700	0.0000	0.7700	49.8495 (79)						
Solar gains	132.7007	215.6536	303.2470	418.4236	473.1122	499.0238	472.4453	420.8820	356.0400	252.8383	163.8297	111.8479 (83)
Total gains	630.1030	709.0608	777.5941	863.2994	887.9613	886.8778	844.4579	800.5077	752.5684	679.0355	622.9876	595.8030 (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	29.9033	29.9981	30.0916	30.5374	30.5374	30.9443	30.8662	30.8662	30.7051	30.5374	30.4512	30.2744
alpha	2.9936	2.9999	3.0061	3.0358	3.0358	3.0630	3.0577	3.0577	3.0470	3.0358	3.0301	3.0183
util living area	0.9439	0.9211	0.8763	0.7834	0.6540	0.4756	0.3185	0.3349	0.5747	0.8038	0.9122	0.9504 (86)
MIT	19.3505	19.5735	19.9640	20.4275	20.7522	20.9346	20.9868	20.9848	20.8796	20.4815	19.8688	19.3179 (87)
Th 2	19.8986	19.9016	19.9047	19.9189	19.9189	19.9315	19.9291	19.9291	19.9241	19.9189	19.9162	19.9105 (88)
util rest of house	0.9341	0.9078	0.8551	0.7472	0.5965	0.3958	0.2214	0.2332	0.4926	0.7617	0.8948	0.9416 (89)
MIT 2	18.4338	18.6518	19.0292	19.4704	19.7519	19.8996	19.9259	19.9254	19.8596	19.5301	18.9539	18.4114 (90)
Living area fraction	fLA = Living area / (4) = 0.2148 (91)											
MIT	18.6307	18.8498	19.2300	19.6760	19.9668	20.1219	20.1538	20.1529	20.0787	19.7344	19.1505	18.6061 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.4807	18.6998	19.0800	19.5260	19.8168	19.9719	20.0038	20.0029	19.9287	19.5844	19.0005	18.4561 (93)

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	578.4549	630.9334	650.2833	632.3227	524.4110	353.8196	192.7739	192.4416	371.0055	507.0489	546.1804	552.0215 (95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000 (96)
Heat loss rate W	1150.7160	1123.6922	1002.3902	819.8053	598.2800	368.9233	194.4573	194.3901	400.8095	669.2255	926.6302	1134.5831 (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	425.7622	331.1339	261.9676	134.9874	54.9585	0.0000	0.0000	0.0000	0.0000	120.6594	273.9239	433.4259 (98)
Space heating	2036.8188 (98)											
Space heating per m2	(98) / (4) = 29.9268 (99)											

#### 8c. Space cooling requirement

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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 %)												90.5000	(206)	
Efficiency of secondary/supplementary heating system, %												0.0000	(208)	
Space heating requirement												2250.6285	(211)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	425.7622	331.1339	261.9676	134.9874	54.9585	0.0000	0.0000	0.0000	0.0000	120.6594	273.9239	433.4259	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	470.4555	365.8938	289.4669	149.1574	60.7277	0.0000	0.0000	0.0000	0.0000	133.3253	302.6783	478.9236	(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	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090	(64)	
Efficiency of water heater (217)m	89.6209	89.5422	89.3500	88.9330	88.2755	87.3000	87.3000	87.3000	87.3000	88.8136	89.3928	87.3000	(216)	
Fuel for water heating, kWh/month	173.5858	152.3928	158.6604	140.4929	136.9483	121.1926	113.9841	128.4077	129.2332	146.0096	156.3934	168.5534	(219)	
Water heating fuel used												1725.8542	(219)	
Annual totals kWh/year												2250.6285	(211)	
Space heating fuel - main system												0.0000	(215)	
Space heating fuel - secondary														
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)												314.3249	(232)	
Total delivered energy for all uses												4365.8076	(238)	

#### 10a. Fuel costs - using BEDF prices (479)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2250.6285	3.7400	84.1735 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1725.8542	3.7400	64.5469 (247)
Pumps and fans for heating	75.0000	19.1200	14.3400 (249)
Energy for lighting	314.3249	19.1200	60.0989 (250)
Additional standing charges			94.0000 (251)
Total energy cost			317.1594 (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	2250.6285	0.2160	486.1358 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1725.8542	0.2160	372.7845 (264)
Space and water heating			858.9203 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	314.3249	0.5190	163.1346 (268)
Total kg/year			1060.9799 (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	2250.6285	1.2200	2745.7668 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1725.8542	1.2200	2105.5421 (264)
Space and water heating			4851.3089 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	314.3249	3.0700	964.9774 (268)
Primary energy kWh/year			6046.5363 (272)
Primary energy kWh/m2/year			88.8413 (273)

#### SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83  
 Current environmental impact rating: B 87

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

(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	Recommended
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	-£ 25	-175 kg (16.5%)
U Solar photovoltaic panels	+ 11.8	-£ 357	-970 kg (109.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£25	2.57 kg/m <sup>2</sup>	B 85 B 89
Solar photovoltaic panels	£357	14.25 kg/m <sup>2</sup>	A 97 A 99
Total Savings	£383	16.83 kg/m <sup>2</sup>	

Potential energy efficiency rating: A 97  
 Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 479 TEST (30 Jun 2021)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, East Anglia):

	Current	Potential	Saving
Electricity	£74	£84	-£10
Mains gas	£243	£208	£35
Space heating	£193	£193	£0
Water heating	£65	£39	£25
Lighting	£60	£0	£60
Generated (PV)	-£0	-£357	£357
Total cost of fuels	£317	-£65	£382
Total cost of uses	£318	-£65	£382
Delivered energy	64 kWh/m <sup>2</sup>	24 kWh/m <sup>2</sup>	40 kWh/m <sup>2</sup>
Carbon dioxide emissions	1.1 tonnes	-0.1 tonnes	1.1 tonnes
CO2 emissions per m <sup>2</sup>	16 kg/m <sup>2</sup>	-1 kg/m <sup>2</sup>	17 kg/m <sup>2</sup>
Primary energy	89 kWh/m <sup>2</sup>	-10 kWh/m <sup>2</sup>	99 kWh/m <sup>2</sup>

# 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	34.0300 (1b)	x 2.3300 (2b)	= 79.2899 (1b) - (3b)
First floor	34.0300 (1c)	x 2.5300 (2c)	= 86.0959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 165.3858 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30.0000 / (5) =	0.1814 (8)							
Pressure test				Yes								
Measured/design AP50					5.0100							
Infiltration rate					0.4319 (18)							
Number of sides sheltered					1 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3995 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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												
Effective ac	0.5094	0.4994	0.4894	0.4395	0.4295	0.3795	0.3795	0.3695	0.3995	0.4295	0.4494	0.4694 (22b)
	0.6297	0.6247	0.6198	0.5966	0.5922	0.5720	0.5720	0.5683	0.5798	0.5922	0.6010	0.6102 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Windows (Uw = 1.30)			11.3000	1.2357	13.9639		(27)					
Solid Door			4.0600	1.2000	4.8720		(26)					
Flr - Ground			34.0330	0.2200	7.4873	75.6000	2572.8948 (28a)					
Wl - Brick	80.2040	15.3580	64.8460	0.2400	15.5630	38.9400	2525.1032 (29a)					
RF - Ins Joist	34.0330		34.0330	0.1000	3.4033	5.8200	198.0721 (30)					
Total net area of external elements Aum(A, m2)			148.2720				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2895		(33)					
Party Wall			39.3810	0.0000	0.0000	54.0300	2127.7554 (32)					
Ground Floor Stud			49.6275			5.8200	288.8323 (32c)					
1st Floor Stud			80.0085			5.8200	465.6496 (32c)					
Internal Floor			34.0400			18.0000	612.7200 (32d)					
Internal Ceiling			34.0400			5.8200	198.1128 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8989.1402 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							132.0767 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3881 (36)					
Total fabric heat loss						(33) + (36) =	49.6776 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 34.3688	Feb 34.0938	Mar 33.8244	Apr 32.5586	May 32.3218	Jun 31.2193	Jul 31.2193	Aug 31.0152	Sep 31.6440	Oct 32.3218	Nov 32.8009	Dec 33.3017 (38)
Heat transfer coeff	84.0464	83.7715	83.5020	82.2362	81.9994	80.8969	80.8969	80.6928	81.3216	81.9994	82.4785	82.9793 (39)
Average = Sum(39)m / 12 =												82.2351 (39)
HLP	Jan 1.2349	Feb 1.2308	Mar 1.2269	Apr 1.2083	May 1.2048	Jun 1.1886	Jul 1.1886	Aug 1.1856	Sep 1.1949	Oct 1.2048	Nov 1.2118	Dec 1.2192 (40)
HLP (average)												1.2083 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1981 (42)
Average daily hot water use (litres/day)												86.4053 (43)
Daily hot water use	95.0459	91.5897	88.1335	84.6772	81.2210	77.7648	77.7648	81.2210	84.6772	88.1335	91.5897	95.0459 (44)
Energy conte	140.9503	123.2760	127.2098	110.9046	106.4156	91.8286	85.0927	97.6451	98.8113	115.1550	125.7007	136.5028 (45)
Energy content (annual)												Total = Sum(45)m = 1359.4925 (45)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	21.1425	18.4914	19.0815	16.6357	15.9623	13.7743	12.7639	14.6468	14.8217	17.2733	18.8551	20.4754 (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	14.6188	13.1798	14.5533	14.0400	14.4762	13.9725	14.4154	14.4548	14.0093	14.5214	14.1037	14.6061 (61)
Total heat required for water heating calculated for each month	155.5691	136.4558	141.7631	124.9446	120.8918	105.8011	99.5081	112.0999	112.8206	129.6764	139.8044	151.1090 (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												1.3340 (H8)
Utilisation factor												0.5274 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												86.4053 (H14)
Volume ratio Veff/V												0.8680 (H15)
Solar storage volume factor												0.9717 (H16)
Solar input												-817.3023 (H17)
Solar input	-23.7001	-39.5487	-67.3560	-90.2703	-111.5214	-109.6433	-108.1943	-94.5299	-74.0359	-50.5578	-28.1118	-19.8330 (63)
Solar input (sum of months) = Sum(63)m =												-817.3023 (63)
Output from w/h												
	131.8690	96.9071	74.4071	34.6743	9.3704	0.0000	0.0000	17.5700	38.7847	79.1186	111.6926	131.2760 (64)
Total per year (kWh/year) = Sum(64)m =												725.6699 (64)
Heat gains from water heating, kWh/month												
	50.5207	44.2842	45.9356	40.3858	39.0022	34.0261	31.8972	36.0807	36.3571	41.9194	45.3214	49.0387 (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	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872	131.8872 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	44.4959	39.5209	32.1406	24.3325	18.1888	15.3558	16.5924	21.5675	28.9478	36.7559	42.8996	45.7326 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	287.6530	290.6380	283.1160	267.1027	246.8887	227.8904	215.1984	212.2135	219.7354	235.7488	255.9627	274.9610 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868	50.3868 (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)	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248	-87.9248 (71)
Water heating gains (Table 5)	67.9041	65.8992	61.7414	56.0914	52.4224	47.2585	42.8725	48.4956	50.4959	56.3433	62.9464	65.9123 (72)
Total internal gains	497.4023	493.4072	474.3472	444.8757	414.8491	387.8539	372.0126	379.6258	396.5284	426.1972	459.1579	483.9551 (73)

#### 6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W				
Northeast	3.4380	11.2829	0.4700	0.0000	0.7700	14.0384 (75)						
Southeast	4.5000	36.7938	0.4700	0.0000	0.7700	59.9206 (77)						
Southwest	3.3610	36.7938	0.4700	0.0000	0.7700	44.7540 (79)						
Solar gains	118.7130	206.8751	295.4413	386.8264	452.2269	457.2917	437.4093	387.3434	326.8882	231.9806	143.0400	101.0441 (83)
Total gains	616.1153	700.2824	769.7885	831.7022	867.0760	845.1457	809.4220	766.9691	723.4166	658.1778	602.1979	584.9992 (84)

#### 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, T <sub>hl</sub> (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil <sub>m</sub> (see Table 9a)												
tau	29.7096	29.8071	29.9033	30.3636	30.4512	30.8662	30.8662	30.9443	30.7051	30.4512	30.2744	30.0916
alpha	2.9806	2.9871	2.9936	3.0242	3.0301	3.0577	3.0577	3.0630	3.0470	3.0301	3.0183	3.0061
util living area	0.9499	0.9268	0.8877	0.8143	0.7017	0.5512	0.4190	0.4554	0.6507	0.8393	0.9265	0.9560 (86)
MIT	19.2427	19.4956	19.8648	20.3124	20.6661	20.8870	20.9635	20.9523	20.8037	20.3494	19.7278	19.1993 (87)
Th 2	19.8922	19.8954	19.8986	19.9134	19.9162	19.9291	19.9291	19.9315	19.9241	19.9162	19.9105	19.9047 (88)
util rest of house	0.9412	0.9144	0.8686	0.7826	0.6506	0.4760	0.3250	0.3601	0.5789	0.8048	0.9120	0.9483 (89)
MIT 2	18.3233	18.5714	18.9297	19.3619	19.6788	19.8664	19.9154	19.9124	19.8049	19.4088	18.8138	18.2903 (90)
Living area fraction												0.2148 (91)
MIT	18.5208	18.7699	19.1306	19.5661	19.8909	20.0856	20.1406	20.1358	20.0195	19.6109	19.0101	18.4856 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3708	18.6199	18.9806	19.4161	19.7409	19.9356	19.9906	19.9858	19.8695	19.4609	18.8601	18.3356 (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	0.9259	0.8967	0.8496	0.7660	0.6416	0.4765	0.3306	0.3652	0.5749	0.7877	0.8945	0.9340	(94)
Useful gains	570.4442	627.9701	654.0203	637.0610	556.2785	402.6760	267.5755	280.0706	415.8619	518.4524	538.6765	546.3974	(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	1182.5993	1149.3398	1042.1512	864.8049	659.3476	431.6339	274.2876	289.3463	469.1829	726.5854	969.9570	1172.9595	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	455.4434	350.3605	288.7694	163.9756	76.6834	0.0000	0.0000	0.0000	0.0000	154.8509	310.5220	466.1622	(98)
Space heating												2266.7673	(98)
Space heating per m2												(98) / (4) =	33.3054 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2504.7152 (211)
Space heating requirement	455.4434	350.3605	288.7694	163.9756	76.6834	0.0000	0.0000	0.0000	0.0000	154.8509	310.5220	466.1622	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	503.2524	387.1386	319.0822	181.1885	84.7330	0.0000	0.0000	0.0000	0.0000	171.1060	343.1182	515.0963	(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	131.8690	96.9071	74.4071	34.6743	9.3704	0.0000	0.0000	17.5700	38.7847	79.1186	111.6926	131.2760	(64)
Efficiency of water heater	89.7612	89.7869	89.8254	89.9246	90.1402	87.3000	87.3000	87.3000	87.3000	89.3920	89.6309	89.7769	(216)
(217)m	89.7612	89.7869	89.8254	89.9246	90.1402	87.3000	87.3000	87.3000	87.3000	89.3920	89.6309	89.7769	(217)
Fuel for water heating, kWh/month	146.9108	107.9301	82.8352	38.5593	10.3954	0.0000	0.0000	20.1260	44.4270	88.5075	124.6140	146.2247	(219)
Water heating fuel used												810.5300	(219)
Annual totals kWh/year													
Space heating fuel - main system													2504.7152 (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)													314.3249 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394			-1727.2394 (233)
Total delivered energy for all uses													2027.3308 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2504.7152	3.4800	87.1641	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	810.5300	3.4800	28.2064	(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	314.3249	13.1900	41.4595	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit		-1727.2394	13.1900	-227.8229 (252)
Total energy cost			65.4946	(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] =	0.2433 (257)
SAP value		96.6059
SAP rating (Section 12)		97 (258)
SAP band		A

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

Energy Emission factor Emissions

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2504.7152	0.2160	541.0185 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	810.5300	0.2160	175.0745 (264)
Space and water heating			716.0930 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	314.3249	0.5190	163.1346 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			47.6653 (272)
CO2 emissions per m2			0.7000 (273)
EI value			99.4351
EI rating			99 (274)
EI band			A

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)  
 CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

#### 1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	34.0300 (1b)	2.3300 (2b)	79.2899 (1b) - (3b)
First floor	34.0300 (1c)	2.5300 (2c)	86.0959 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	68.0600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 165.3858 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour							
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)							
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)							
Number of intermittent fans				3 * 10 =	30.0000 (7a)							
Number of passive vents				0 * 10 =	0.0000 (7b)							
Number of flueless gas fires				0 * 40 =	0.0000 (7c)							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1814 (8)							
Pressure test				Yes								
Measured/design AP50					5.0100							
Infiltration rate					0.4319 (18)							
Number of sides sheltered					1 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3995 (21)							
Wind speed	Jan 4.9000	Feb 4.8000	Mar 4.7000	Apr 4.2000	May 4.2000	Jun 3.7000	Jul 3.8000	Aug 3.8000	Sep 4.0000	Oct 4.2000	Nov 4.3000	Dec 4.5000 (22)
Wind factor	1.2250	1.2000	1.1750	1.0500	1.0500	0.9250	0.9500	0.9500	1.0000	1.0500	1.0750	1.1250 (22a)
Adj infilt rate												
Effective ac	0.4894	0.4794	0.4694	0.4195	0.4195	0.3695	0.3795	0.3795	0.3995	0.4195	0.4295	0.4494 (22b)
	0.6198	0.6149	0.6102	0.5880	0.5880	0.5683	0.5720	0.5720	0.5798	0.5880	0.5922	0.6010 (25)

#### 3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Windows (Uw = 1.30)			11.3000	1.2357	13.9639		(27)
Solid Door			4.0600	1.2000	4.8720		(26)
Flr - Ground			34.0330	0.2200	7.4873	75.6000	2572.8948 (28a)
Wl - Brick	80.2040	15.3580	64.8460	0.2400	15.5630	38.9400	2525.1032 (29a)
RF - Ins Joist	34.0330		34.0330	0.1000	3.4033	5.8200	198.0721 (30)
Total net area of external elements Aum(A, m2)			148.2720				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	45.2895		(33)
Party Wall			39.3810	0.0000	0.0000	54.0300	2127.7554 (32)
Ground Floor Stud			49.6275			5.8200	288.8323 (32c)
1st Floor Stud			80.0085			5.8200	465.6496 (32c)
Internal Floor			34.0400			18.0000	612.7200 (32d)
Internal Ceiling			34.0400			5.8200	198.1128 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 8989.1402 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							132.0767 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.3881 (36)
Total fabric heat loss							(33) + (36) = 49.6776 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	33.8244	33.5603	33.3017	32.0904	32.0904	31.0152	31.2193	31.2193	31.6440	32.0904	32.3218	32.8009 (38)
Average = Sum(39)m / 12 =	83.5020	83.2379	82.9793	81.7680	81.7680	80.6928	80.8969	80.8969	81.3216	81.7680	81.9994	82.4785 (39)
HLP	1.2269	1.2230	1.2192	1.2014	1.2014	1.1856	1.1886	1.1886	1.1949	1.2014	1.2048	1.2118 (40)
HLP (average)												1.2040 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												2.1981 (42)
Average daily hot water use (litres/day)												86.4053 (43)
Daily hot water use	95.0459	91.5897	88.1335	84.6772	81.2210	77.7648	77.7648	81.2210	84.6772	88.1335	91.5897	95.0459 (44)
Energy conte	140.9503	123.2760	127.2098	110.9046	106.4156	91.8286	85.0927	97.6451	98.8113	115.1550	125.7007	136.5028 (45)
Energy content (annual)												Total = Sum(45)m = 1359.4925 (45)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9180	0.8898	0.8363	0.7324	0.5906	0.3989	0.2283	0.2404	0.4930	0.7467	0.8767	0.9265	(94)
Useful gains	578.4549	630.9334	650.2833	632.3227	524.4110	353.8196	192.7739	192.4416	371.0055	507.0489	546.1804	552.0215	(95)
Ext temp.	4.7000	5.2000	7.0000	9.5000	12.5000	15.4000	17.6000	17.6000	15.0000	11.4000	7.7000	4.7000	(96)
Heat loss rate W	1150.7160	1123.6922	1002.3902	819.8053	598.2800	368.9233	194.4573	194.3901	400.8095	669.2255	926.6302	1134.5831	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	425.7622	331.1339	261.9676	134.9874	54.9585	0.0000	0.0000	0.0000	0.0000	120.6594	273.9239	433.4259	(98)
Space heating												2036.8188	(98)
Space heating per m2												29.9268	(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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2250.6285	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	425.7622	331.1339	261.9676	134.9874	54.9585	0.0000	0.0000	0.0000	0.0000	120.6594	273.9239	433.4259	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	470.4555	365.8938	289.4669	149.1574	60.7277	0.0000	0.0000	0.0000	0.0000	133.3253	302.6783	478.9236	(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	130.2052	96.9956	75.7150	31.9903	10.1354	0.0000	0.0000	14.4430	35.8843	76.9601	108.9783	130.0923	(64)	
Efficiency of water heater	89.7297	89.7546	89.7623	89.8689	89.9864	87.3000	87.3000	87.3000	87.3000	89.2263	89.5656	89.7406	(217)	
Fuel for water heating, kWh/month	145.1082	108.0675	84.3506	35.5966	11.2633	0.0000	0.0000	16.5441	41.1045	86.2527	121.6743	144.9648	(219)	
Water heating fuel used												794.9266	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2250.6285	(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)													314.3249	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1168 * 0.80) =									-1869.2537				-1869.2537	(233)
Total delivered energy for all uses													1615.6263	(238)

#### 10a. Fuel costs - using BEDF prices (479)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2250.6285	3.7400	84.1735	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	794.9266	3.7400	29.7303	(247)
Pumps and fans for heating	75.0000	19.1200	14.3400	(249)
Pump for solar water heating	50.0000	19.1200	9.5600	(249)
Energy for lighting	314.3249	19.1200	60.0989	(250)
Additional standing charges			94.0000	(251)
Energy saving/generation technologies				
PV Unit	-1869.2537	19.1200	-357.4013	(252)
Total energy cost			-65.4986	(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	2250.6285	0.2160	486.1358	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	794.9266	0.2160	171.7041	(264)
Space and water heating			657.8399	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	314.3249	0.5190	163.1346	(268)
Energy saving/generation technologies				
PV Unit	-1869.2537	0.5190	-970.1427	(269)
Total kg/year			-84.2931	(272)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)



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

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 13a. Primary energy - Individual heating systems including micro-CHP  
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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2250.6285	1.2200	2745.7668 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	794.9266	1.2200	969.8105 (264)
Space and water heating			3715.5773 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	314.3249	3.0700	964.9774 (268)
Energy saving/generation technologies			
PV Unit	-1869.2537	3.0700	-5738.6088 (269)
Primary energy kWh/year			-674.3041 (272)
Primary energy kWh/m2/year			-9.9075 (273)

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



<b>Property Reference</b>	134 - PRJ011855	<b>Issued on Date</b>	02/08/2021	
<b>Assessment Reference</b>	134 E	<b>Prop Type Ref</b>	BLO-0283 SIN BR-ET 4.1	
<b>Property</b>	134 - PRJ011855			
<b>SAP Rating</b>	83 B	<b>DER</b>	17.99	
<b>Environmental</b>	87 B	<b>TER</b>	19.06	
<b>CO<sub>2</sub> Emissions (t/year)</b>	1.06	<b>% DER&lt;TER</b>	5.60	
<b>General Requirements Compliance</b>	Pass	<b>DFEE</b>	43.64	
		<b>TFEE</b>	51.68	
		<b>% DFEE&lt;TFEE</b>	15.55	
<b>Assessor Details</b>	Mr. Michael Juckes, Michael Juckes, Tel: 02033971373, michael@briaryenergy.co.uk		<b>Assessor ID</b>	T850-0001
<b>Client</b>				

### 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)	19.06	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	17.99	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-1.07 (-5.6%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.68	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	43.64	kWh/m <sup>2</sup> /yr	
	-8.1 (-15.7%)	kWh/m <sup>2</sup> /yr	Pass

#### Criterion 2 – Limits on design flexibility

##### Limiting Fabric Standards

##### 2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.22 (max. 0.25)	0.22 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.27 (max. 2.00)	1.30 (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	5.01 (design value)	
Maximum	10.0	Pass

##### Limiting System Efficiencies

##### 4 Heating efficiency

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)



Main heating system

Boiler system with radiators or underfloor - Mains gas  
Data from database  
Ideal LOGIC COMBI ESP1 30  
Combi boiler  
Efficiency: 89.6% 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 (East Anglia)

Slight

Pass

Based on:

Overshading

Average

Windows facing North East

3.44 m<sup>2</sup>, No overhang

Windows facing South East

4.50 m<sup>2</sup>, No overhang

Windows facing South West

3.36 m<sup>2</sup>, No overhang

Air change rate

4.21 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

## Criterion 4 – Building performance consistent with DER and DFEE rate

### Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00 W/m<sup>2</sup>K

Pass

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

### 10 Key features

Party wall U-value

0.00 W/m<sup>2</sup>K

Roof U-value

0.10 W/m<sup>2</sup>K

Thermal bridging  $\gamma$ -value

0.030 W/m<sup>2</sup>K

*This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.*