



elmhurst  
energy



## SAP Report Submission for Building Regulations Compliance

Client: ABL Homes Ltd

Project: Dockenfield Barn, Boundary Road  
Dockenfield, Surrey, GU10 4EU

Contact: Scott Spearing | BEAT Solutions  
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Report Issue Date: 05/11/2019

EXCELLENCE  
IN ENERGY  
ASSESSMENT

# SUMMARY FOR INPUT DATA

## Calculation Type: Conversion (As Designed)

Property Reference	SAP-1043	Issued on Date	05/11/2019
Assessment Reference	Rev -	Prop Type Ref	
Property	Dockenfield Barn, Boundary Road, Dockenfield, Surrey, GU10 4EU		
SAP Rating	74 C	DER	N/A
Environmental	50 E	% DER<TER	N/A
CO <sub>2</sub> Emissions (t/year)	3.68	DFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
Client	ABL Homes Ltd, ABL HOMES		

### SUMMARY FOR INPUT DATA FOR: Conversion (As Designed)

Orientation	West					
Property Tenure	Unknown					
Transaction Type	New dwelling					
Terrain Type	Rural					
1.0 Property Type	Bungalow, Detached					
2.0 Number of Storeys	1					
3.0 Date Built	2019					
4.0 Sheltered Sides	0					
5.0 Sunlight/Shade	Average or unknown					
6.0 Measurements						
		Heat Loss Perimeter	Internal Floor Area	Average Storey Height		
	Ground Floor:	32.28 m	64.09 m <sup>2</sup>	2.38 m		
7.0 Living Area	32.13	m <sup>2</sup>				
8.0 Thermal Mass Parameter	Precise calculation					
Thermal Mass	105.18	kJ/m <sup>2</sup> K				
9.0 External Walls						
Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Gross Area (m <sup>2</sup> )	Nett Area (m <sup>2</sup> )
External Walls	Timber Frame	Timber framed wall (one layer of plasterboard)	0.17	9.00	76.83	57.84
9.2 Internal Walls						
Description	Construction			Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )	
Internal Walls	Plasterboard on timber frame			9.00	92.96	
10.0 External Roofs						
Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Gross Area (m <sup>2</sup> )	Nett Area (m <sup>2</sup> )
Pitched Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.15	9.00	64.09	64.09
11.0 Heat Loss Floors						
Description	Type	Construction	U-Value (W/m <sup>2</sup> K)	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )	
Heat Loss Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.20	75.00	64.09	
12.0 Opening Types						

# SUMMARY FOR INPUT DATA

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Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m <sup>2</sup> K)
Front Door	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft	0.05		0.63		0.70	1.40
Bi-Fold Door	Manufacturer	Window	Double Low-E Soft	0.05		0.63		0.70	1.40

### 13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m <sup>2</sup> )	Curtain Closed
Front Door	Solid Door	[1] External Walls	West							2.40	
Front Elevation	Window	[1] External Walls	West	None	0.00					5.34	
Side Elevation	Window	[1] External Walls	North	None	0.00					0.83	
Rear Elevation	Window	[1] External Walls	East	None	0.00					2.38	
Bi-Fold Door	Window	[1] External Walls	East	None	0.00					5.76	
Side Elevation	Window	[1] External Walls	South	None	0.00					2.28	

### 14.0 Conservatory

### 15.0 Draught Proofing

 %

### 16.0 Draught Lobby

### 17.0 Thermal Bridging

Y-value

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

### 18.0 Pressure Testing

### 19.0 Mechanical Ventilation

#### Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

#### Mechanical Ventilation

Mechanical Ventilation System Present

### 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

### 22.0 Lighting

#### Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings  %

#### External

External lights fitted

### 23.0 Electricity Tariff

### 24.0 Main Heating 1

# SUMMARY FOR INPUT DATA

## Calculation Type: Conversion (As Designed)

Description	Electric Boiler	
Percentage of Heat	100	%
Main Heating	BEC	
SAP Code	195	
Efficiency (SAP Table)	100.0	%
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
<hr/>		
<b>25.0 Main Heating 2</b>	None	
<hr/>		
Community Heating	None	
<b>28.0 Water Heating</b>	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	
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<b>29.0 Hot Water Cylinder</b>	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	150.00	L
Loss	1.50	kWh/day
Pipes insulation	Uninsulated primary pipework	
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<b>31.0 Thermal Store</b>	None	

### Recommendations

#### Lower cost measures

None

Further measures to achieve even higher standards

# SUMMARY FOR INPUT DATA

## Calculation Type: Conversion (As Designed)

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£74	C 76	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£349	B 89	
	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Wind turbine	£15,000 - £25,000	£675	A 116	

# U-VALUE CALCULATOR REPORT

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## Building Elements

### Roof Pitched Roof

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	<b>ROCKWOOL ROLL</b> Main construction Corrections - Air Gap: Level 0, Fasteners: None or plastic	100	0.0440	2.2727	100.00
Layer 2	<b>ROCKWOOL ROLL</b> Main construction Corrections - Air Gap: Level 0, Fasteners: None or plastic	100	0.0440	2.2727	100.00
Layer 3	<b>ROCKWOOL ROLL</b> Main construction Main construction Corrections - Air Gap: Level 1, Fasteners: None or plastic	100 100	0.0440 0.1300	2.2727 0.7692	91.67 8.33
Layer 4	<b>Plasterboard, standard</b> Main construction	12.5	0.2100	0.0595	100.00
Layer 5	<b>Plaster, standard</b> Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance: Upper limit = 6.869 m<sup>2</sup> K/W      Lower limit = 6.707 m<sup>2</sup> K/W      Average = 6.788 m<sup>2</sup> K/W  
Total correction = 0.0008 m<sup>2</sup> K/W      U-value (unrounded) = 0.15 W/m<sup>2</sup> K

Unheated space: None

Total thickness: 316 mm

U-value: 0.15 W/m<sup>2</sup> K

Kappa: n/a

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## Building Elements

### Wall External Walls

#### Wall Type: Timber framed Wall with I-beams

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	<b>Hardwood, dry</b>				
	Main construction	25	0.1800	0.1389	100.00
Layer 2	<b>airspace/timber battens</b>				
	Main construction	50	0.2778	0.1800	91.67
	Main construction	50	0.1300	0.3846	8.33
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	<b>Breather membrane</b>				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	<b>Plywood</b>				
	Main construction	19	0.1300	0.1462	100.00
Layer 5	<b>Kooltherm K12 Frame board (45mm +)</b>				
	Main construction	120	0.0200	6.0000	87.50
	Main construction	120	0.1300	0.9231	12.50
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 6	<b>Timber Frame Void</b>				
	Main construction	20	0.1143	0.1750	87.50
	Main construction	20	0.1300	0.1538	12.50
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 7	<b>Kooltherm K18 Insulated Plasterboard (32.5mm)</b>				
	Main construction	32.5	0.0361	0.9000	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 8	<b>Plaster, standard</b>				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance: Upper limit = 6.239 m<sup>2</sup> K/W Lower limit = 5.278 m<sup>2</sup> K/W Average = 5.759 m<sup>2</sup> K/W  
 Total correction = 0.0041 m<sup>2</sup> K/W U-value (unrounded) = 0.17 W/m<sup>2</sup> K

Unheated space: None

**Total thickness: 271 mm**

**U-value: 0.17 W/m<sup>2</sup> K**

**Kappa: n/a**

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## Building Elements

### Floor Ground Floor

Floor Type: Suspended Floor

Area = 64.09 m<sup>2</sup>, Perimeter = 32.28 m, Wall thickness = 275.00 mm, Soil: Unknown

Depth of underfloor space below ground: 0.200 m Floor wind shielding: Average (suburban)

Floor height above ground: h = 0.200 m

U-value of walls above ground: U<sub>w</sub> = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R<sub>g</sub> = 0.000 m<sup>2</sup>K/W

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	<b>Concrete, reinforced (1% steel)</b>				
	Main construction	100	2.3000	0.0000	100.00
Layer 2	<b>Ventilation Void</b>				
	Main construction	150	0.0000	0.0000	100.00
	Corrections - Cavity Ventilated, Emissivity: Normal				
Layer 3	<b>Kooltherm K3 Floorboard (45mm +)</b>				
	Main construction	120	0.0200	6.0000	85.71
	Main construction	120	0.1300	0.9231	14.29
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	<b>Polythene, 500 gauge</b>				
	Main construction	1	0.0000	0.0000	100.00
Layer 5	<b>Chipboard</b>				
	Main construction	22	0.1300	0.1692	100.00
Int surface				0.1700	

Total resistance: Upper limit = 4.321 m<sup>2</sup> K/W Lower limit = 3.869 m<sup>2</sup> K/W Average = 4.095 m<sup>2</sup> K/W

Total correction = 0.0067 m<sup>2</sup> K/W

U-value (unrounded) = 0.2 W/m<sup>2</sup> K

Unheated space: None

**Total thickness: 393 mm**

**U-value: 0.20 W/m<sup>2</sup> K**

**Kappa: n/a**



# FULL SAP CALCULATION PRINTOUT

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### CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (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	64.0900 (1b)	x 2.3800 (2b)	= 152.5342 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5342 (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) =	0.1967 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.9467 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.9467 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.0000	3.9000	3.6000	3.7000	3.3000	3.3000	3.1000	3.1000	3.4000	3.4000	3.8000 (22)
Wind factor	1.0750	1.0000	0.9750	0.9000	0.9250	0.8250	0.8250	0.7750	0.7750	0.8500	0.8500	0.9500 (22a)
Adj infiltr rate												
Effective ac	1.0177	0.9467	0.9230	0.8520	0.8757	0.7810	0.7810	0.7337	0.7337	0.8047	0.8047	0.8993 (22b)
	1.0177	0.9481	0.9260	0.8630	0.8834	0.8050	0.8050	0.7691	0.7691	0.8238	0.8238	0.9044 (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
Front Door			2.4000	1.4000	3.3600		(26)
Windows (Uw = 1.40)			10.8300	1.3258	14.3580		(27)
Bi-Fold Door (Uw = 1.40)			5.7600	1.3258	7.6364		(27)
Heat Loss Floor			64.0900	0.2000	12.8180	75.0000	4806.7500 (28a)
External Walls	76.8300	18.9900	57.8400	0.1700	9.8328	9.0000	520.5600 (29a)
Pitched Roof	64.0900		64.0900	0.1500	9.6135	9.0000	576.8100 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			205.0100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	57.6186	(33)
Internal Walls			92.9600			9.0000	836.6400 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	6740.7600 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							105.1765 (35)
Thermal bridges (Default value 0.150 * total exposed area)							30.7515 (36)
Total fabric heat loss						(33) + (36) =	88.3701 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	51.2261	47.7238	46.6101	43.4382	44.4673	40.5201	40.5201	38.7156	38.7156	41.4646	41.4646	45.5246 (38)
Heat transfer coeff												

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Average =	Sum(39)m / 12 =	139.5962	136.0939	134.9802	131.8083	132.8374	128.8902	128.8902	127.0857	127.0857	129.8347	129.8347	133.8947 (39)	131.7360 (39)
HLP	(average)	Jan 2.1781	Feb 2.1235	Mar 2.1061	Apr 2.0566	May 2.0727	Jun 2.0111	Jul 2.0111	Aug 1.9829	Sep 1.9829	Oct 2.0258	Nov 2.0258	Dec 2.0892	2.0555 (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														2.0946 (42)
Average daily hot water use (litres/day)														83.9468 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Energy content (annual)	92.3415	88.9836	85.6258	82.2679	78.9100	75.5522	75.5522	78.9100	82.2679	85.6258	88.9836	92.3415	111.8785	132.6189 (44)
Distribution loss (46)m = 0.15 x (45)m	136.9398	119.7684	123.5903	107.7490	103.3877	89.2158	82.6715	94.8668	95.9998	111.8785	122.1241	132.6189	132.6189	1320.8106 (45)
Water storage loss:	20.5410	17.9653	18.5385	16.1624	15.5082	13.3824	12.4007	14.2300	14.4000	16.7818	18.3186	19.8928	19.8928	19.8928 (46)
Store volume														150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														1.5000 (48)
Temperature factor from Table 2b														0.5400 (49)
Enter (49) or (54) in (55)														0.8100 (55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	25.1100 (56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	25.1100 (57)
Primary loss	43.3132	39.1216	43.3132	41.9160	43.3132	41.9160	43.3132	43.3132	41.9160	43.3132	41.9160	43.3132	43.3132	43.3132 (59)
Total heat required for water heating calculated for each month	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	201.0421	201.0421 (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	0.0000	0.0000 (63)
Output from w/h	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	201.0421	201.0421 (64)
RHI water heating demand														2126 (64)
Heat gains from water heating, kWh/month	100.2710	89.2643	95.8323	88.7993	89.1150	82.6370	82.2268	86.2818	84.8927	91.9382	93.5791	98.8343	98.8343	98.8343 (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	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8158	36.2523	29.4823	22.3200	16.6845	14.0857	15.2201	19.7837	26.5536	33.7160	39.3515	41.9502	41.9502	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3311	276.1674	269.0200	253.8039	234.5964	216.5440	204.4839	201.6476	208.7950	224.0111	243.2186	261.2710	261.2710	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	(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	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	(71)
Water heating gains (Table 5)	134.7729	132.8338	128.8069	123.3324	119.7782	114.7737	110.5199	115.9701	117.9066	123.5728	129.9709	132.8419	132.8419	(72)
Total internal gains	543.4741	539.8077	521.8635	494.0107	465.6134	439.9577	424.7783	431.9557	447.8096	475.8541	507.0953	530.6174	530.6174	(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		0.8300	13.1177	0.6300	0.7000	0.7700	3.3274 (74)						
East		2.3800	24.4891	0.6300	0.7000	0.7700	17.8124 (76)						
South		2.2800	55.4171	0.6300	0.7000	0.7700	38.6145 (78)						
West		5.3400	24.4891	0.6300	0.7000	0.7700	39.9656 (80)						
East		5.7600	24.4891	0.6300	0.7000	0.7700	43.1089 (76)						
Solar gains	142.8288	229.9501	353.1258	502.4781	583.4056	635.9029	595.9965	527.3289	431.8075	285.3097	171.9726	116.1853	116.1853 (83)
Total gains	686.3029	769.7579	874.9893	996.4888	1049.0189	1075.8606	1020.7748	959.2846	879.6170	761.1638	679.0679	646.8026	646.8026 (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	13.4132	13.7584	13.8719	14.2057	14.0957	14.5274	14.5274	14.7336	14.7336	14.4217	14.4217	13.9844	13.9844	
alpha	1.8942	1.9172	1.9248	1.9470	1.9397	1.9685	1.9685	1.9822	1.9822	1.9614	1.9614	1.9323	1.9323	
util living area	0.9263	0.9066	0.8637	0.7889	0.6876	0.5321	0.4050	0.4383	0.6436	0.8148	0.8985	0.9316	0.9316	(86)
MIT	18.3789	18.6291	19.1271	19.7116	20.2129	20.6103	20.7654	20.7469	20.4546	19.8243	19.0775	18.4135	18.4135	(87)
Th 2	19.2172	19.2523	19.2635	19.2959	19.2853	19.3260	19.3260	19.3447	19.3447	19.3162	19.3162	19.2746	19.2746	(88)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

util rest of house	0.9120	0.8889	0.8365	0.7449	0.6138	0.4152	0.2426	0.2780	0.5418	0.7662	0.8762	0.9185 (89)
MIT 2	16.9548	17.2229	17.7128	18.2878	18.7305	19.0776	19.1698	19.1812	18.9905	18.4245	17.7119	17.0301 (90)
Living area fraction									fLA = Living area / (4) =			0.5013 (91)
MIT	17.6687	17.9279	18.4218	19.0016	19.4737	19.8460	19.9697	19.9661	19.7245	19.1262	18.3965	17.7237 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6687	17.9279	18.4218	19.0016	19.4737	19.8460	19.9697	19.9661	19.7245	19.1262	18.3965	17.7237 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8960	0.8719	0.8204	0.7360	0.6230	0.4549	0.3097	0.3431	0.5682	0.7596	0.8609	0.9032 (94)
Useful gains	614.8979	671.1816	717.8205	733.3947	653.4878	489.3563	316.1713	329.1503	499.7851	578.1791	584.6332	584.2076 (95)
Ext temp.	4.6000	5.1000	7.0000	9.4000	12.4000	15.3000	17.3000	17.1000	14.5000	11.1000	7.5000	4.6000 (96)
Heat loss rate W	1824.3469	1745.7960	1541.7216	1265.5673	939.6475	585.9288	344.1033	364.2448	663.9582	1042.0847	1414.7456	1757.1880 (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	899.8301	722.1409	612.9824	383.1642	212.9028	0.0000	0.0000	0.0000	0.0000	345.1458	597.6809	872.6974 (98)
Space heating												4646.5445 (98)
RHI space heating demand												4647 (98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	64.0900 (1b)	x 2.3800 (2b)	= 152.5342 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5342 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1967 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.9467 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.9467 (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	1.2070	1.1833	1.1597	1.0413	1.0177	0.8993	0.8993	0.8757	0.9467	1.0177	1.0650	1.1123 (22b)
Effective ac	1.2070	1.1833	1.1597	1.0413	1.0177	0.9044	0.9044	0.8834	0.9481	1.0177	1.0650	1.1123 (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
Front Door			2.4000	1.4000	3.3600		(26)
Windows (Uw = 1.40)			10.8300	1.3258	14.3580		(27)
Bi-Fold Door (Uw = 1.40)			5.7600	1.3258	7.6364		(27)
Heat Loss Floor			64.0900	0.2000	12.8180	75.0000	4806.7500 (28a)
External Walls	76.8300	18.9900	57.8400	0.1700	9.8328	9.0000	520.5600 (29a)
Pitched Roof	64.0900		64.0900	0.1500	9.6135	9.0000	576.8100 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			205.0100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 57.6186		(33)
Internal Walls			92.9600			9.0000	836.6400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6740.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							105.1765 (35)
Thermal bridges (Default value 0.150 * total exposed area)							30.7515 (36)
Total fabric heat loss						(33) + (36) =	88.3701 (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	60.7566	59.5653	58.3740	52.4174	51.2261	45.5246	45.5246	44.4673	47.7238	51.2261	53.6087	55.9914 (38)
Heat transfer coeff	149.1267	147.9354	146.7441	140.7876	139.5962	133.8947	133.8947	132.8374	136.0939	139.5962	141.9789	144.3615 (39)
Average = Sum(39)m / 12 =												140.5706 (39)
HLP	2.3268	2.3082	2.2897	2.1967	2.1781	2.0892	2.0892	2.0727	2.1235	2.1781	2.2153	2.2525 (40)
HLP (average)												2.1933 (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												2.0946 (42)
Average daily hot water use (litres/day)												83.9468 (43)
Daily hot water use	92.3415	88.9836	85.6258	82.2679	78.9100	75.5522	75.5522	78.9100	82.2679	85.6258	88.9836	92.3415 (44)
Energy conte	136.9398	119.7684	123.5903	107.7490	103.3877	89.2158	82.6715	94.8668	95.9998	111.8785	122.1241	132.6189 (45)
Energy content (annual)										Total = Sum(45)m =		1320.8106 (45)
Distribution loss (46)m = 0.15 x (45)m	20.5410	17.9653	18.5385	16.1624	15.5082	13.3824	12.4007	14.2300	14.4000	16.7818	18.3186	19.8928 (46)
Water storage loss:												
Store volume												150.0000 (47)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):																							1.5000 (48)	
Temperature factor from Table 2b																								0.5400 (49)
Enter (49) or (54) in (55)																								0.8100 (55)
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100 (56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100 (57)
Primary loss	43.3132	39.1216	43.3132	41.9160	43.3132	41.9160	43.3132	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132 (59)
Total heat required for water heating calculated for each month	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	201.0421 (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	0.0000 (63)											
Output from w/h	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	201.0421 (64)											
Heat gains from water heating, kWh/month	100.2710	89.2643	95.8323	88.7993	89.1150	82.6370	82.2268	86.2818	84.8927	91.9382	93.5791	98.8343	98.8343 (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	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8158	36.2523	29.4823	22.3200	16.6845	14.0857	15.2201	19.7837	26.5536	33.7160	39.3515	41.9502	41.9502 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3311	276.1674	269.0200	253.8039	234.5964	216.5440	204.4839	201.6476	208.7950	224.0111	243.2186	261.2710	261.2710 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622 (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	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841 (71)
Water heating gains (Table 5)	134.7729	132.8338	128.8069	123.3324	119.7782	114.7737	110.5199	115.9701	117.9066	123.5728	129.9709	132.8419	132.8419 (72)
Total internal gains	543.4741	539.8077	521.8635	494.0107	465.6134	439.9577	424.7783	431.9557	447.8096	475.8541	507.0953	530.6174	530.6174 (73)

#### 6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains						
		m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W						
			W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d							
North		0.8300	10.6334	0.6300	0.7000	0.7700	2.6973 (74)						
East		2.3800	19.6403	0.6300	0.7000	0.7700	14.2855 (76)						
South		2.2800	46.7521	0.6300	0.7000	0.7700	32.5767 (78)						
West		5.3400	19.6403	0.6300	0.7000	0.7700	32.0524 (80)						
East		5.7600	19.6403	0.6300	0.7000	0.7700	34.5734 (76)						
Solar gains	116.1853	216.7865	337.3842	471.0430	564.8981	574.2539	548.2669	478.1512	384.6877	251.4934	142.8288	96.9353	96.9353 (83)
Total gains	659.6594	756.5942	859.2477	965.0537	1030.5114	1014.2117	973.0452	910.1069	832.4972	727.3475	649.9241	627.5527	627.5527 (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	12.5560	12.6571	12.7599	13.2997	13.4132	13.9844	13.9844	14.0957	13.7584	13.4132	13.1881	12.9705	12.9705											
alpha	1.8371	1.8438	1.8507	1.8866	1.8942	1.9323	1.9323	1.9397	1.9172	1.8942	1.8792	1.8647	1.8647											
util living area	0.9344	0.9144	0.8796	0.8159	0.7269	0.6023	0.4879	0.5238	0.6960	0.8442	0.9133	0.9391	0.9391 (86)											
MIT	18.1541	18.4079	18.8594	19.4920	20.0362	20.4844	20.6869	20.6558	20.3141	19.6032	18.8093	18.1580	18.1580 (87)											
Th 2	19.1243	19.1358	19.1472	19.2054	19.2172	19.2746	19.2746	19.2853	19.2523	19.2172	19.1937	19.1703	19.1703 (88)											
util rest of house	0.9214	0.8974	0.8547	0.7757	0.6604	0.4943	0.3324	0.3717	0.5996	0.8012	0.8934	0.9272	0.9272 (89)											
MIT 2	16.6694	16.9248	17.3714	18.0167	18.5241	18.9459	19.0841	19.0791	18.8064	18.1470	17.3647	16.7058	16.7058 (90)											
Living area fraction																								
MIT	17.4137	17.6683	18.1173	18.7563	19.2822	19.7172	19.8876	19.8695	19.5623	18.8770	18.0889	17.4338	17.4338 (92)											
Temperature adjustment													0.0000											
adjusted MIT	17.4137	17.6683	18.1173	18.7563	19.2822	19.7172	19.8876	19.8695	19.5623	18.8770	18.0889	17.4338	17.4338 (93)											

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9057	0.8802	0.8374	0.7637	0.6632	0.5253	0.3931	0.4292	0.6194	0.7911	0.8776	0.9121	0.9121 (94)
Ext temp.	597.4339	665.9279	719.4986	736.9970	683.4342	532.7167	382.5018	390.5898	515.6795	575.3940	570.3926	572.4178	572.4178 (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	4.2000 (96)
1955.6071	1888.8848	1704.7746	1387.6507	1058.4436	685.1669	440.1925	460.8820	743.3792	1155.4368	1560.1949	1910.4511	1910.4511 (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	1.0000 (97a)
Space heating kWh	1010.4809	821.8270	733.0453	468.4707	279.0070	0.0000	0.0000	0.0000	0.0000	431.5519	712.6576	995.4968	995.4968 (98)
Space heating per m <sup>2</sup>													5452.5372 (98)
													(98) / (4) = 85.0763 (99)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (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 %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5452.5372 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1010.4809	821.8270	733.0453	468.4707	279.0070	0.0000	0.0000	0.0000	0.0000	431.5519	712.6576	995.4968	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	1010.4809	821.8270	733.0453	468.4707	279.0070	0.0000	0.0000	0.0000	0.0000	431.5519	712.6576	995.4968	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	(219)
Water heating fuel used													2126.4386 (219)
Annual totals kWh/year													
Space heating fuel - main system													5452.5372 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													288.3282 (232)
Total delivered energy for all uses													7897.3040 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5452.5372	5.5000	299.8895 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2126.4386	5.5000	116.9541 (247)
Pumps and fans for heating (0.90*15.29 + 0.10*5.50)	30.0000	14.3110	4.2933 (249)
Energy for lighting (0.90*15.29 + 0.10*5.50)	288.3282	14.3110	41.2626 (250)
Additional standing charges			24.0000 (251)
Total energy cost			486.3996 (255)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.8727 (257)
SAP value		73.8765
SAP rating (Section 12)		74 (258)
SAP band		C

#### 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	5452.5372	0.5190	2829.8668 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2126.4386	0.5190	1103.6216 (264)
Space and water heating			3933.4885 (265)
Pumps and fans	30.0000	0.5190	15.5700 (267)
Energy for lighting	288.3282	0.5190	149.6423 (268)
Total kg/year			4098.7008 (272)
CO2 emissions per m2			63.9500 (273)
EI value			50.3882
EI rating			50 (274)
EI band			E

#### Calculation of stars for heating and DHW

Main heating energy efficiency	$5.50 \times (1 + 0.29 \times 0.25) / 1.0000 = 5.899$ , stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 1.0000 = 0.5566$ , stars = 1
Water heating energy efficiency	$5.50 / 1.0000 = 5.500$ , stars = 3
Water heating environmental impact	$0.519 / 1.0000 = 0.5190$ , stars = 2

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

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

SAP 2012 WORKSHEET FOR Conversion (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	64.0900 (1b)	x 2.3800 (2b)	= 152.5342 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5342 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1967 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.9467 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.9467 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.0000	3.9000	3.6000	3.7000	3.3000	3.3000	3.1000	3.1000	3.4000	3.4000	3.8000 (22)
Wind factor	1.0750	1.0000	0.9750	0.9000	0.9250	0.8250	0.8250	0.7750	0.7750	0.8500	0.8500	0.9500 (22a)
Adj infilt rate	1.0177	0.9467	0.9230	0.8520	0.8757	0.7810	0.7810	0.7337	0.7337	0.8047	0.8047	0.8993 (22b)
Effective ac	1.0177	0.9481	0.9260	0.8630	0.8834	0.8050	0.8050	0.7691	0.7691	0.8238	0.8238	0.9044 (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
Front Door			2.4000	1.4000	3.3600		(26)
Windows (Uw = 1.40)			10.8300	1.3258	14.3580		(27)
Bi-Fold Door (Uw = 1.40)			5.7600	1.3258	7.6364		(27)
Heat Loss Floor			64.0900	0.2000	12.8180	75.0000	4806.7500 (28a)
External Walls	76.8300	18.9900	57.8400	0.1700	9.8328	9.0000	520.5600 (29a)
Pitched Roof	64.0900		64.0900	0.1500	9.6135	9.0000	576.8100 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			205.0100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 57.6186		(33)
Internal Walls			92.9600			9.0000	836.6400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6740.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							105.1765 (35)
Thermal bridges (Default value 0.150 * total exposed area)							30.7515 (36)
Total fabric heat loss						(33) + (36) =	88.3701 (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	51.2261	47.7238	46.6101	43.4382	44.4673	40.5201	40.5201	38.7156	38.7156	41.4646	41.4646	45.5246 (38)
Heat transfer coeff	139.5962	136.0939	134.9802	131.8083	132.8374	128.8902	128.8902	127.0857	127.0857	129.8347	129.8347	133.8947 (39)
Average = Sum(39)m / 12 =												131.7360 (39)
HLP	2.1781	2.1235	2.1061	2.0566	2.0727	2.0111	2.0111	1.9829	1.9829	2.0258	2.0258	2.0892 (40)
HLP (average)												2.0555 (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													2.0946 (42)
Average daily hot water use (litres/day)													83.9468 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3415	88.9836	85.6258	82.2679	78.9100	75.5522	75.5522	78.9100	82.2679	85.6258	88.9836	92.3415 (44)	
Energy conte	136.9398	119.7684	123.5903	107.7490	103.3877	89.2158	82.6715	94.8668	95.9998	111.8785	122.1241	132.6189 (45)	
Energy content (annual)												Total = Sum(45)m = 1320.8106 (45)	
Distribution loss (46)m = 0.15 x (45)m	20.5410	17.9653	18.5385	16.1624	15.5082	13.3824	12.4007	14.2300	14.4000	16.7818	18.3186	19.8928 (46)	
Water storage loss:													
Store volume													150.0000 (47)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

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

a) If manufacturer declared loss factor is known (kWh/day):																							1.5000 (48)	
Temperature factor from Table 2b																							0.5400 (49)	
Enter (49) or (54) in (55)																							0.8100 (55)	
Total storage loss	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100 (56)
If cylinder contains dedicated solar storage	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100	24.3000	25.1100 (57)
Primary loss	43.3132	39.1216	43.3132	41.9160	43.3132	41.9160	43.3132	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132	41.9160	43.3132 (59)
Total heat required for water heating calculated for each month	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	201.0421 (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	0.0000 (63)											
Output from w/h	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	201.0421 (64)											
Heat gains from water heating, kWh/month	100.2710	89.2643	95.8323	88.7993	89.1150	82.6370	82.2268	86.2818	84.8927	91.9382	93.5791	98.8343	98.8343 (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	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762	125.6762 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	40.8158	36.2523	29.4823	22.3200	16.6845	14.0857	15.2201	19.7837	26.5536	33.7160	39.3515	41.9502	41.9502 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.3311	276.1674	269.0200	253.8039	234.5964	216.5440	204.4839	201.6476	208.7950	224.0111	243.2186	261.2710	261.2710 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622	49.6622 (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	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841	-83.7841 (71)
Water heating gains (Table 5)	134.7729	132.8338	128.8069	123.3324	119.7782	114.7737	110.5199	115.9701	117.9066	123.5728	129.9709	132.8419	132.8419 (72)
Total internal gains	543.4741	539.8077	521.8635	494.0107	465.6134	439.9577	424.7783	431.9557	447.8096	475.8541	507.0953	530.6174	530.6174 (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						
North		0.8300	13.1177	0.6300	0.7000	0.7700	3.3274	3.3274 (74)					
East		2.3800	24.4891	0.6300	0.7000	0.7700	17.8124	17.8124 (76)					
South		2.2800	55.4171	0.6300	0.7000	0.7700	38.6145	38.6145 (78)					
West		5.3400	24.4891	0.6300	0.7000	0.7700	39.9656	39.9656 (80)					
East		5.7600	24.4891	0.6300	0.7000	0.7700	43.1089	43.1089 (76)					
Solar gains	142.8288	229.9501	353.1258	502.4781	583.4056	635.9029	595.9965	527.3289	431.8075	285.3097	171.9726	116.1853	116.1853 (83)
Total gains	686.3029	769.7579	874.9893	996.4888	1049.0189	1075.8606	1020.7748	959.2846	879.6170	761.1638	679.0679	646.8026	646.8026 (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	13.4132	13.7584	13.8719	14.2057	14.0957	14.5274	14.5274	14.7336	14.7336	14.4217	14.4217	13.9844	13.9844											
alpha	1.8942	1.9172	1.9248	1.9470	1.9397	1.9685	1.9685	1.9822	1.9822	1.9614	1.9614	1.9323	1.9323											
util living area	0.9263	0.9066	0.8637	0.7889	0.6876	0.5321	0.4050	0.4383	0.6436	0.8148	0.8985	0.9316	0.9316 (86)											
MIT	18.3789	18.6291	19.1271	19.7116	20.2129	20.6103	20.7654	20.7469	20.4546	19.8243	19.0775	18.4135	18.4135 (87)											
Th 2	19.2172	19.2523	19.2635	19.2959	19.2853	19.3260	19.3260	19.3447	19.3447	19.3162	19.3162	19.2746	19.2746 (88)											
util rest of house	0.9120	0.8889	0.8365	0.7449	0.6138	0.4152	0.2426	0.2780	0.5418	0.7662	0.8762	0.9185	0.9185 (89)											
MIT 2	16.9548	17.2229	17.7128	18.2878	18.7305	19.0776	19.1698	19.1812	18.9905	18.4245	17.7119	17.0301	17.0301 (90)											
Living area fraction										fLA = Living area / (4) =		0.5013	0.5013 (91)											
MIT	17.6687	17.9279	18.4218	19.0016	19.4737	19.8460	19.9697	19.9661	19.7245	19.1262	18.3965	17.7237	17.7237 (92)											
Temperature adjustment												0.0000	0.0000											
adjusted MIT	17.6687	17.9279	18.4218	19.0016	19.4737	19.8460	19.9697	19.9661	19.7245	19.1262	18.3965	17.7237	17.7237 (93)											

#### 8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8960	0.8719	0.8204	0.7360	0.6230	0.4549	0.3097	0.3431	0.5682	0.7596	0.8609	0.9032	0.9032 (94)
Useful gains	614.8979	671.1816	717.8205	733.3947	653.4878	489.3563	316.1713	329.1503	499.7851	578.1791	584.6332	584.2076	584.2076 (95)
Ext temp.	4.6000	5.1000	7.0000	9.4000	12.4000	15.3000	17.3000	17.1000	14.5000	11.1000	7.5000	4.6000	4.6000 (96)
Heat loss rate W	1824.3469	1745.7960	1541.7216	1265.5673	939.6475	585.9288	344.1033	364.2448	663.9582	1042.0847	1414.7456	1757.1880	1757.1880 (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	1.0000 (97a)
Space heating kWh	899.8301	722.1409	612.9824	383.1642	212.9028	0.0000	0.0000	0.0000	0.0000	345.1458	597.6809	872.6974	872.6974 (98)
Space heating												4646.5445	4646.5445 (98)
Space heating per m <sup>2</sup>													(98) / (4) = 72.5003 (99)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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 %)													100.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4646.5445 (211)
Space heating requirement	899.8301	722.1409	612.9824	383.1642	212.9028	0.0000	0.0000	0.0000	0.0000	345.1458	597.6809	872.6974	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	899.8301	722.1409	612.9824	383.1642	212.9028	0.0000	0.0000	0.0000	0.0000	345.1458	597.6809	872.6974	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	(64)
Efficiency of water heater (217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)
Fuel for water heating, kWh/month	205.3630	181.5700	192.0135	173.9650	171.8109	155.4318	151.0947	163.2900	162.2158	180.3017	188.3401	201.0421	(219)
Water heating fuel used													2126.4386 (219)
Annual totals kWh/year													
Space heating fuel - main system													4646.5445 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans: central heating pump													30.0000 (230c)
Total electricity for the above, kWh/year													30.0000 (231)
Electricity for lighting (calculated in Appendix L)													288.3282 (232)
Total delivered energy for all uses													7091.3113 (238)

10a. Fuel costs - using BEDF prices (450)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4646.5445	8.1300	377.7641	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2126.4386	8.1300	172.8795	(247)
Pumps and fans for heating (0.90*20.72 + 0.10*8.13)	30.0000	19.4610	5.8383	(249)
Energy for lighting (0.90*20.72 + 0.10*8.13)	288.3282	19.4610	56.1115	(250)
Additional standing charges			11.0000	(251)
Total energy cost			623.5934	(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	4646.5445	0.5190	2411.5566	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2126.4386	0.5190	1103.6216	(264)
Space and water heating			3515.1782	(265)
Pumps and fans	30.0000	0.5190	15.5700	(267)
Energy for lighting	288.3282	0.5190	149.6423	(268)
Total kg/year			3680.3906	(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	4646.5445	3.0700	14264.8917	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2126.4386	3.0700	6528.1665	(264)
Space and water heating			20793.0582	(265)
Pumps and fans	30.0000	3.0700	92.1000	(267)
Energy for lighting	288.3282	3.0700	885.1675	(268)
Primary energy kWh/year			21770.3257	(272)
Primary energy kWh/m2/year			339.6837	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: C 74  
Current environmental impact rating: E 50

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (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	Recommended
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.6	-£ 74	-506 kg (13.7%)
U Solar photovoltaic panels	+ 12.8	-£ 349	-980 kg (30.9%)
V2 Wind turbine	+ 26.8	-£ 675	-1856 kg (84.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£74	7.89 kg/m <sup>2</sup>	C 76 D 56
Solar photovoltaic panels	£349	15.29 kg/m <sup>2</sup>	B 89 D 67
Wind turbine	£675	28.95 kg/m <sup>2</sup>	A 116 B 90
<b>Total Savings</b>	<b>£1098</b>	<b>52.13 kg/m<sup>2</sup></b>	

Potential energy efficiency rating: A 116  
 Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 450 TEST (30 Oct 2019)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£624	£550	£74
Space heating	£395	£397	-£3
Water heating	£173	£97	£76
Lighting	£56	£56	£0
Generated (PV)	-£0	-£349	£349
Generated (wind)	-£0	-£675	£675
<b>Total cost of fuels</b>	<b>£624</b>	<b>-£474</b>	<b>£1098</b>
<b>Total cost of uses</b>	<b>£624</b>	<b>-£474</b>	<b>£1097</b>
Delivered energy	111 kWh/m <sup>2</sup>	10 kWh/m <sup>2</sup>	100 kWh/m <sup>2</sup>
Carbon dioxide emissions	3.7 tonnes	0.3 tonnes	3.3 tonnes
CO2 emissions per m <sup>2</sup>	57 kg/m <sup>2</sup>	5 kg/m <sup>2</sup>	52 kg/m <sup>2</sup>
Primary energy	340 kWh/m <sup>2</sup>	31 kWh/m <sup>2</sup>	308 kWh/m <sup>2</sup>

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

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

SAP 2012 WORKSHEET FOR Conversion (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	64.0900 (1b)	x 2.3800 (2b)	= 152.5342 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5342 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1967 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.9467 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.9467 (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	1.2070	1.1833	1.1597	1.0413	1.0177	0.8993	0.8993	0.8757	0.9467	1.0177	1.0650	1.1123 (22b)
Effective ac	1.2070	1.1833	1.1597	1.0413	1.0177	0.9044	0.9044	0.8834	0.9481	1.0177	1.0650	1.1123 (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
Front Door			2.4000	1.4000	3.3600		(26)
Windows (Uw = 1.40)			10.8300	1.3258	14.3580		(27)
Bi-Fold Door (Uw = 1.40)			5.7600	1.3258	7.6364		(27)
Heat Loss Floor			64.0900	0.2000	12.8180	75.0000	4806.7500 (28a)
External Walls	76.8300	18.9900	57.8400	0.1700	9.8328	9.0000	520.5600 (29a)
Pitched Roof	64.0900		64.0900	0.1500	9.6135	9.0000	576.8100 (30)
Total net area of external elements Aum(A, m2)			205.0100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 57.6186		(33)
Internal Walls			92.9600			9.0000	836.6400 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		6740.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							105.1765 (35)
Thermal bridges (Default value 0.150 * total exposed area)							30.7515 (36)
Total fabric heat loss						(33) + (36) =	88.3701 (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	60.7566	59.5653	58.3740	52.4174	51.2261	45.5246	45.5246	44.4673	47.7238	51.2261	53.6087	55.9914 (38)
Heat transfer coeff	149.1267	147.9354	146.7441	140.7876	139.5962	133.8947	133.8947	132.8374	136.0939	139.5962	141.9789	144.3615 (39)
Average = Sum(39)m / 12 =												140.5706 (39)
HLP	2.3268	2.3082	2.2897	2.1967	2.1781	2.0892	2.0892	2.0727	2.1235	2.1781	2.2153	2.2525 (40)
HLP (average)												2.1933 (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													2.0946 (42)
Average daily hot water use (litres/day)													83.9468 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	92.3415	88.9836	85.6258	82.2679	78.9100	75.5522	75.5522	78.9100	82.2679	85.6258	88.9836	92.3415 (44)	
Energy conte	136.9398	119.7684	123.5903	107.7490	103.3877	89.2158	82.6715	94.8668	95.9998	111.8785	122.1241	132.6189 (45)	
Energy content (annual)										Total = Sum(45)m =		1320.8106 (45)	
Distribution loss (46)m = 0.15 x (45)m	20.5410	17.9653	18.5385	16.1624	15.5082	13.3824	12.4007	14.2300	14.4000	16.7818	18.3186	19.8928 (46)	
Water storage loss:													
Store volume												190.0000 (47)	



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (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	0.9072	0.8818	0.8398	0.7694	0.6730	0.5362	0.4036	0.4402	0.6267	0.7945	0.8796	0.9137	(94)
Useful gains	591.3172	660.2255	712.6432	725.7304	671.0285	525.6317	379.0358	386.5268	509.7559	569.4373	564.7447	566.2036	(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													
	1954.2201	1887.5868	1703.2087	1385.1224	1055.7098	683.6758	439.4558	460.0237	742.0958	1154.1020	1558.9300	1909.0633	(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													
	1013.9998	824.7868	736.9808	474.7623	286.2029	0.0000	0.0000	0.0000	0.0000	434.9905	715.8134	999.0877	(98)
Space heating													5486.6242
Space heating per m2													(98) / (4) = 85.6081

#### 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 %)														100.0000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														5486.6242	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1013.9998	824.7868	736.9808	474.7623	286.2029	0.0000	0.0000	0.0000	0.0000	434.9905	715.8134	999.0877	(98)		
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)		
Space heating fuel (main heating system)	1013.9998	824.7868	736.9808	474.7623	286.2029	0.0000	0.0000	0.0000	0.0000	434.9905	715.8134	999.0877	(211)		
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)		
Water heating															
Water heating requirement	174.1257	135.0456	114.1173	63.2023	28.1169	14.2186	10.3254	38.0442	70.3529	119.3593	152.8864	173.7078	(64)		
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)		
(217)m	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(217)		
Fuel for water heating, kWh/month	174.1257	135.0456	114.1173	63.2023	28.1169	14.2186	10.3254	38.0442	70.3529	119.3593	152.8864	173.7078	(219)		
Water heating fuel used													1093.5022		
Annual totals kWh/year															
Space heating fuel - main system													5486.6242		
Space heating fuel - secondary													0.0000		
Electricity for pumps and fans:															
central heating pump													30.0000		
pump for solar water heating													50.0000		
Total electricity for the above, kWh/year													80.0000		
Electricity for lighting (calculated in Appendix L)													288.3282		
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394			-1727.2394		
Wind generation													-3575.5408		
Total delivered energy for all uses													1645.6745		

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5486.6242	5.5000	301.7643	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1093.5022	5.5000	60.1426	(247)
Pumps and fans for heating (0.90*15.29 + 0.10*5.50)	30.0000	14.3110	4.2933	(249)
Pump for solar water heating	50.0000	14.3110	7.1555	(249)
Energy for lighting (0.90*15.29 + 0.10*5.50)	288.3282	14.3110	41.2626	(250)
Additional standing charges			24.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*20.72 + 0.10*8.13)	-1727.2394	13.7505	-237.5041	(252)
Wind Turbine (0.90*20.72 + 0.10*8.13)	-3575.5408	13.9747	-499.6711	(252)
Total energy cost			-298.5567	(255)

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

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)		-1.1495	(257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	116.0349	
SAP rating (Section 12)		116	(258)
SAP band		A	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5486.6242	0.5190	2847.5580 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1093.5022	0.5190	567.5276 (264)
Space and water heating			3415.0856 (265)
Pumps and fans	80.0000	0.5190	41.5200 (267)
Energy for lighting	288.3282	0.5190	149.6423 (268)
Energy saving/generation technologies			
PV Unit (0.90*20.72 + 0.10*8.13)	-1727.2394	0.5190	-896.4372 (269)
Wind Turbine (0.90*20.72 + 0.10*8.13)	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			854.1051 (272)
CO2 emissions per m2			13.3300 (273)
EI value			89.5087
EI rating			90 (274)
EI band			B

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

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

SAP 2012 WORKSHEET FOR Conversion (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	64.0900 (1b)	x 2.3800 (2b)	= 152.5342 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	64.0900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 152.5342 (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)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1967 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.9467 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.9467 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.0000	3.9000	3.6000	3.7000	3.3000	3.3000	3.1000	3.1000	3.4000	3.4000	3.8000 (22)
Wind factor	1.0750	1.0000	0.9750	0.9000	0.9250	0.8250	0.8250	0.7750	0.7750	0.8500	0.8500	0.9500 (22a)
Adj infilt rate	1.0177	0.9467	0.9230	0.8520	0.8757	0.7810	0.7810	0.7337	0.7337	0.8047	0.8047	0.8993 (22b)
Effective ac	1.0177	0.9481	0.9260	0.8630	0.8834	0.8050	0.8050	0.7691	0.7691	0.8238	0.8238	0.9044 (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
Front Door			2.4000	1.4000	3.3600		(26)
Windows (Uw = 1.40)			10.8300	1.3258	14.3580		(27)
Bi-Fold Door (Uw = 1.40)			5.7600	1.3258	7.6364		(27)
Heat Loss Floor			64.0900	0.2000	12.8180	75.0000	4806.7500 (28a)
External Walls	76.8300	18.9900	57.8400	0.1700	9.8328	9.0000	520.5600 (29a)
Pitched Roof	64.0900		64.0900	0.1500	9.6135	9.0000	576.8100 (30)
Total net area of external elements Aum(A, m2)			205.0100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 57.6186		(33)
Internal Walls			92.9600			9.0000	836.6400 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6740.7600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							105.1765 (35)
Thermal bridges (Default value 0.150 * total exposed area)							30.7515 (36)
Total fabric heat loss						(33) + (36) =	88.3701 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	51.2261	47.7238	46.6101	43.4382	44.4673	40.5201	40.5201	38.7156	38.7156	41.4646	41.4646	45.5246 (38)
Heat transfer coeff	139.5962	136.0939	134.9802	131.8083	132.8374	128.8902	128.8902	127.0857	127.0857	129.8347	129.8347	133.8947 (39)
Average = Sum(39)m / 12 =												131.7360 (39)
HLP	2.1781	2.1235	2.1061	2.0566	2.0727	2.0111	2.0111	1.9829	1.9829	2.0258	2.0258	2.0892 (40)
HLP (average)												2.0555 (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												2.0946 (42)
Average daily hot water use (litres/day)												83.9468 (43)
Daily hot water use	92.3415	88.9836	85.6258	82.2679	78.9100	75.5522	75.5522	78.9100	82.2679	85.6258	88.9836	92.3415 (44)
Energy conte	136.9398	119.7684	123.5903	107.7490	103.3877	89.2158	82.6715	94.8668	95.9998	111.8785	122.1241	132.6189 (45)
Energy content (annual)										Total = Sum(45)m =		1320.8106 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	20.5410	17.9653	18.5385	16.1624	15.5082	13.3824	12.4007	14.2300	14.4000	16.7818	18.3186	19.8928 (46)
Store volume												190.0000 (47)





# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (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	0.8976	0.8737	0.8230	0.7420	0.6331	0.4650	0.3185	0.3526	0.5753	0.7633	0.8631	0.9049	(94)
Useful gains	608.9647	665.6436	711.3527	723.1962	642.9495	484.4942	314.3314	326.9126	495.0985	572.8373	579.2859	578.1697	(95)
Ext temp.	4.6000	5.1000	7.0000	9.4000	12.4000	15.3000	17.3000	17.1000	14.5000	11.1000	7.5000	4.6000	(96)
Heat loss rate W	1823.0338	1744.5774	1540.2961	1263.3558	937.4002	584.9355	343.7051	363.7715	662.9876	1040.9301	1413.5916	1755.8784	(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	903.2674	725.0435	616.7339	388.9149	219.0713	0.0000	0.0000	0.0000	0.0000	348.2610	600.7002	876.2153	(98)
Space heating												4678.2074	(98)
Space heating per m2												72.9943	(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 %)														100.0000	(206)
Efficiency of secondary/supplementary heating system, %														0.0000	(208)
Space heating requirement														4678.2074	(211)
Space heating requirement	903.2674	725.0435	616.7339	388.9149	219.0713	0.0000	0.0000	0.0000	0.0000	348.2610	600.7002	876.2153	(98)		
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)		
Space heating fuel (main heating system)	903.2674	725.0435	616.7339	388.9149	219.0713	0.0000	0.0000	0.0000	0.0000	348.2610	600.7002	876.2153	(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	170.4777	135.2560	115.3256	63.0192	31.4112	9.6716	7.9334	34.5860	66.3341	116.0877	149.2296	171.2327	(64)		
Efficiency of water heater	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	100.0000	(216)		
Fuel for water heating, kWh/month	170.4777	135.2560	115.3256	63.0192	31.4112	9.6716	7.9334	34.5860	66.3341	116.0877	149.2296	171.2327	(219)		
Water heating fuel used												1070.5648	(219)		
Annual totals kWh/year															
Space heating fuel - main system														4678.2074	(211)
Space heating fuel - secondary														0.0000	(215)
Electricity for pumps and fans:															
central heating pump														30.0000	(230c)
pump for solar water heating														50.0000	(230g)
Total electricity for the above, kWh/year														80.0000	(231)
Electricity for lighting (calculated in Appendix L)														288.3282	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 2.50 * 1180 * 0.80) =														-1887.9744	(233)
Wind generation														-3575.5408	(234)
Total delivered energy for all uses														653.5852	(238)

#### 10a. Fuel costs - using BEDF prices (450)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4678.2074	8.1300	380.3383	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1070.5648	8.1300	87.0369	(247)
Pumps and fans for heating (0.90*20.72 + 0.10*8.13)	30.0000	19.4610	5.8383	(249)
Pump for solar water heating	50.0000	19.4610	9.7305	(249)
Energy for lighting (0.90*20.72 + 0.10*8.13)	288.3282	19.4610	56.1115	(250)
Additional standing charges			11.0000	(251)
Energy saving/generation technologies				
PV Unit (0.90*20.72 + 0.10*8.13)	-1887.9744	18.5105	-349.4735	(252)
Wind Turbine (0.90*20.72 + 0.10*8.13)	-3575.5408	18.8907	-675.4447	(252)
Total energy cost			-474.8627	(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	4678.2074	0.5190	2427.9897	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1070.5648	0.5190	555.6231	(264)
Space and water heating			2983.6128	(265)
Pumps and fans	80.0000	0.5190	41.5200	(267)
Energy for lighting	288.3282	0.5190	149.6423	(268)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Designed)

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

Energy saving/generation technologies			
PV Unit (0.90*20.72 + 0.10*8.13)	-1887.9744	0.5190	-979.8587 (269)
Wind Turbine (0.90*20.72 + 0.10*8.13)	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			339.2107 (272)

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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	4678.2074	3.0700	14362.0968 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1070.5648	3.0700	3286.6340 (264)
Space and water heating			17648.7308 (265)
Pumps and fans	80.0000	3.0700	245.6000 (267)
Energy for lighting	288.3282	3.0700	885.1675 (268)
Energy saving/generation technologies			
PV Unit (0.90*20.72 + 0.10*8.13)	-1887.9744	3.0700	-5796.0815 (269)
Wind Turbine (0.90*20.72 + 0.10*8.13)	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			2006.5067 (272)
Primary energy kWh/m2/year			31.3076 (273)

# PREDICTED ENERGY ASSESSMENT

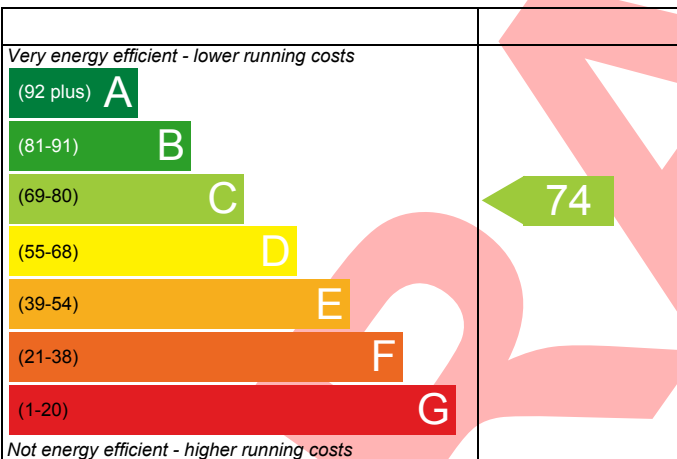
Dockenfield Barn, Boundary Road,  
Dockenfield,  
Surrey,  
GU10 4EU

Dwelling type: Bungalow, Detached  
Date of assessment: 05/11/2019  
Produced by: Scott Spearing  
Total floor area: 64.09 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.

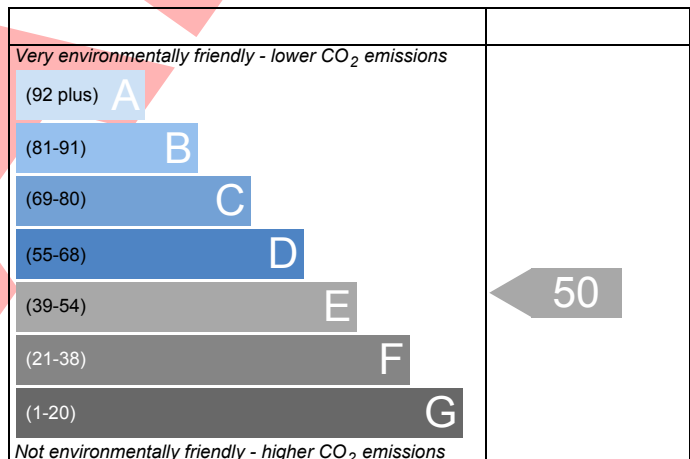
## Energy Efficiency Rating



**England** EU Directive 2002/91/EC

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 (CO<sub>2</sub>) Rating



**England** EU Directive 2002/91/EC

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.*