



elmhurst  
energy



## SAP Report Submission for Building Regulations Compliance

Client: Sutton & Wilkinson Architects

Project: Plot 1, Carnfloss  
St Merryn, Nr Padstow, Cornwall, PL28 8NF

Contact: Kim Oliver  
Energy Services (Midlands) Ltd  
[kim@energyservice.co.uk](mailto:kim@energyservice.co.uk)

Report Issue Date: 12/10/2022

EXCELLENCE  
IN ENERGY  
ASSESSMENT

# BASIC COMPLIANCE REPORT

## Calculation Type: New Build (As Designed)

<b>Property Reference</b>	SAP04876 - Plot 01	<b>Issued on Date</b>	12/10/2022	
<b>Assessment Reference</b>	As Designed	<b>Prop Type Ref</b>	New Dwelling	
<b>Property</b>	Plot 1, Carnfloss, St Merryn, Nr Padstow, Cornwall, PL28 8NF			
<b>SAP Rating</b>	84 B	<b>DER</b>	13.72	
<b>Environmental</b>	85 B	<b>TER</b>	15.17	
<b>CO<sub>2</sub> Emissions (t/year)</b>	2.91	<b>% DER&lt;TER</b>	9.55	
<b>General Requirements Compliance</b>	Pass	<b>DFEE</b>	51.45	
		<b>TFEE</b>	61.95	
		<b>% DFEE&lt;TFEE</b>	16.94	
<b>Assessor Details</b>	Ms. Kim Oliver, Energy Services (Midlands) Ltd, Tel: 0121 5528425, kim@energyservice.co.uk		<b>Assessor ID</b>	L757-0001
<b>Client</b>	Sutton & Wilkinson Architects, Sutton & Wilkinson Architects			

### 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)	15.17	kgCO <sub>2</sub> /m <sup>2</sup>	
Dwelling Carbon Dioxide Emission Rate (DER)	13.72	kgCO <sub>2</sub> /m <sup>2</sup>	Pass
	-1.45 (-9.6%)	kgCO <sub>2</sub> /m <sup>2</sup>	

##### 1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.95	kWh/m <sup>2</sup> /yr	
Dwelling Fabric Energy Efficiency (DFEE)	51.45	kWh/m <sup>2</sup> /yr	
	-10.4 (-16.8%)	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	0.18 (max. 0.30)	0.18 (max. 0.70)	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.15 (max. 0.20)	0.18 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.50 (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	6.00 (design value)	
Maximum	10.0	Pass

##### Limiting System Efficiencies

##### 4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Worcester Greenstar 8000 Style GR8700iW 35 SB NG  Efficiency: 89.3% SEDBUK2009 Minimum: 88.0%	Pass
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# BASIC COMPLIANCE REPORT

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Secondary heating system	Room heaters - Wood Logs Closed room heater Efficiency: 65% Minimum: 65%	Pass
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### 5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.89 kWh/day Permitted by DBSCG 2.86	Pass
Primary pipework insulated	Yes	Pass

### Solar water heating

Dedicated solar storage volume	150 litres	
Minimum	86 litres	Pass

### 6 Controls

Space heating controls	Time and temperature zone control	Pass
Hot water controls	Cylinderstat Independent timer for DHW	Pass
Boiler interlock	Yes	Pass

### 7 Low energy lights

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

### 8 Mechanical ventilation

Continuous supply and extract system			
Specific fan power	1.04		
Maximum	1.5		Pass
MVHR efficiency	93	%	
Minimum	70	%	Pass

## Criterion 3 – Limiting the effects of heat gains in summer

### 9 Summertime temperature

Overheating risk (South West England)	Not significant	Pass
Based on:		
Overshading	Average	
Windows facing North East	5.41 m <sup>2</sup> , No overhang	
Windows facing South East	14.44 m <sup>2</sup> , No overhang	
Windows facing South West	11.10 m <sup>2</sup> , No overhang	
Windows facing North West	29.02 m <sup>2</sup> , No overhang	
Air change rate	5.00 ach	
Blinds/curtains	None	

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

### Air permeability and pressure testing

#### 3 Air permeability

Air permeability at 50 pascals	6.00 (design value)	
Maximum	10.0	Pass

# BASIC COMPLIANCE REPORT

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### 10 Key features

Roof U-value	0.09	W/m <sup>2</sup> K
Floor U-value	0.11	W/m <sup>2</sup> K
Door U-value	1.10	W/m <sup>2</sup> K
Secondary heating (wood logs)	N/A	
Secondary heating fuel:	wood logs	
Solar water heating	N/A	

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

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

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

#### 6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	48.85 m	129.09 m <sup>2</sup>	2.50 m
1st Storey:	47.30 m	123.80 m <sup>2</sup>	3.10 m

7.0 Living Area  m<sup>2</sup>

8.0 Thermal Mass Parameter  
 Thermal Mass  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 Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.18	9.00	244.18	178.26

#### 9.2 Internal Walls

Description	Construction	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
GF x 2.5 FF x 2.85	Plasterboard on timber frame	9.00	415.91

#### 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> )
Insulated Sloping Rafter	External Slope Roof	Plasterboard, insulated slope	0.16	9.00	127.32	125.48
Insulated Ceiling - 450mm	External Plane Roof	Other	0.09	10.50	25.65	25.65
Flat Roof Bay/Entrance	External Flat Roof	Plasterboard, insulated flat roof	0.18	9.00	3.99	3.99

#### 10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
GF Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	129.09

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

### 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> )
Ground Floor - 150mm pIR	Ground Floor - Solid	Other	0.11	117.00	129.09

### 11.2 Internal Floors

Description	Construction	Kappa (kJ/m <sup>2</sup> K)	Area (m <sup>2</sup> )
FF Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	123.80

### 12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m <sup>2</sup> K)
New Glazing	Manufacture	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Solid Doors	Manufacture	Solid Door							1.10
Half Glazed Door	Manufacture	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.50
rooflights	Manufacture	Roof 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 - Wet Room	Window	[1] External Wall	South East	None	0.00					0.72	
Front - Hallway	Half Glazed Door	[1] External Wall	South East							3.80	
Front - Study x2	Window	[1] External Wall	South East	None	0.00					3.43	
Front - B4 & B3	Window	[1] External Wall	South East	None	0.00					5.96	
Front - B4 Apex	Window	[1] External Wall	South East	None	0.00					1.35	
Front - Landing	Window	[1] External Wall	South East	None	0.00					1.03	
Front - Dining Bay	Window	[1] External Wall	South East	None	0.00					1.95	
Rear - Dining Bay	Window	[1] External Wall	North West	None	0.00					1.95	
Rear - Dining	Window	[1] External Wall	North West	None	0.00					8.29	
Rear - Lounge	Window	[1] External Wall	North West	None	0.00					8.29	
Rear - Masterx2	Window	[1] External Wall	North West	None	0.00					5.87	
Rear - D07	Window	[1] External Wall	North West	None	0.00					4.62	
Side - W15 & 16	Window	[1] External Wall	North East	None	0.00					1.44	
Side - Maste D06	Window	[1] External Wall	North East	None	0.00					2.15	
Side - Study	Window	[1] External Wall	North East	None	0.00					0.96	
Side - Hallway	Window	[1] External Wall	North East	None	0.00					0.86	
Side - Dining Bay	Window	[1] External Wall	South West	None	0.00					3.47	
Side - Kitchen	Window	[1] External Wall	South West	None	0.00					1.31	
Side - Utility	Window	[1] External Wall	South West	None	0.00					0.84	
Side - Utility	Solid Door	[1] External Wall	South West							2.15	
Side - Ensuites x 2	Window	[1] External Wall	South West	None	0.00					1.68	
Side - D05	Window	[1] External Wall	South West	None	0.00					3.80	
W18 RL	Roof Window	[1] Insulated Sloping Rafter	South East	None						0.92	
W18 RL	Roof Window	[1] Insulated Sloping Rafter	North West	None						0.92	

### 14.0 Conservatory

### 15.0 Draught Proofing

%

### 16.0 Draught Lobby

### 17.0 Thermal Bridging

### 17.1 List of Bridges

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	38.39	0.030	Yes	Frame Homes EJ2
Independently assessed	E3 Sill	35.55	0.020	Yes	Frame Homes EJ1
Independently assessed	E4 Jamb	82.30	0.030	Yes	Frame Homes EJ3
Independently assessed	E5 Ground floor (normal)	48.85	0.060	Yes	Frame Homes GF1
Independently assessed	E6 Intermediate floor within a dwelling	47.30	0.090	Yes	Frame Homes WF1 & WF2
Independently assessed	E11 Eaves (insulation at rafter level)	18.99	0.040	No	Frame Homes WR3
Independently assessed	E12 Gable (insulation at ceiling level)	4.50	0.090	No	Frame Homes WR4
Independently assessed	E13 Gable (insulation at rafter level)	24.40	0.050	No	Frame Homes WR5
Table K1 - Default	E14 Flat roof	9.10	0.080	No	
Independently assessed	E16 Corner (normal)	42.70	0.090	No	Frame Homes PC5
Independently assessed	E17 Corner (inverted – internal area greater than external area)	17.30	0.000	No	Frame Homes PC4
Table K1 - Default	R1 Head of roof window	1.56	0.080	No	
Table K1 - Default	R2 Sill of roof window	1.56	0.060	No	
Table K1 - Default	R3 Jamb of roof window	4.72	0.080	No	
Table K1 - Default	R4 Ridge (vaulted ceiling)	8.20	0.080	No	
Table K1 - Default	R5 Ridge (inverted)	13.20	0.040	No	
Table K1 - Default	R8 Roof to wall (rafter)	21.10	0.060	No	

Y-value  W/m<sup>2</sup>K

### 18.0 Pressure Testing

Pressure Testing	<input type="text" value="Yes"/>	
Designed AP <sub>50</sub>	<input type="text" value="6.00"/>	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa
Property Tested ?	<input type="text"/>	
As Built AP <sub>50</sub>	<input type="text"/>	m <sup>3</sup> /(h.m <sup>2</sup> ) @ 50 Pa

### 19.0 Mechanical Ventilation

#### Summer Overheating

Windows open in hot weather	<input type="text" value="Calculated rate"/>
Night Ventilation	<input type="text" value="No"/>
Air change rate	<input type="text" value="5.00"/>

#### Mechanical Ventilation

Mechanical Ventilation System Present	<input type="text" value="Yes"/>
Approved Installation	<input type="text" value="Yes"/>
Mechanical Ventilation data Type	<input type="text" value="Database"/>
Type	<input type="text" value="Balanced mechanical ventilation with heat recovery"/>
MV Reference Number	<input type="text" value="500481"/>
Configuration	<input type="text" value="7"/>
MVHR Duct Insulated	<input type="text" value="Yes"/>
Manufacturer SFP	<input type="text" value="1.04"/>
Duct Type	<input type="text" value="Rigid"/>
MVHR Efficiency	<input type="text" value="93.00"/>
Wet Rooms	<input type="text" value="7"/>

### 20.0 Fans, Open Fireplaces, Flues

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

### 21.0 Fixed Cooling System

# SUMMARY FOR INPUT DATA

## Calculation Type: New Build (As Designed)

### 22.0 Lighting

#### Internal

Total number of light fittings	50	
Total number of L.E.L. fittings	50	
Percentage of L.E.L. fittings	100.00	%

#### External

External lights fitted	No	
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### 23.0 Electricity Tariff

Standard
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### 24.0 Main Heating 1

Database	Database	
Percentage of Heat	100	%
Database Ref. No.	18455	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.3	
In Summer	79.6	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Unknown	

### 25.0 Main Heating 2

None
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Community Heating	None	
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### 27.0 Secondary Heating

RWM		
Secondary Heating	SAP table	
Description	Wood Logs RWM Closed room heater	
SHS efficiency	65.00	%
SAP Code	633	
HETAS Approved System	Yes	
Smoke Control Area	Unknown	

### 28.0 Water Heating

HWP From main heating 1	
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No



# SUMMARY FOR INPUT DATA

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Solar Panel	Yes	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	
<b>29.0 Hot Water Cylinder</b>		
Hot Water Cylinder	Hot Water Cylinder	
Cylinder Stat	Yes	
Cylinder In Heated Space	Yes	
Independent Time Control	Yes	
Insulation Type	Measured Loss	
Cylinder Volume	300.00	L
Loss	1.89	kWh/day
Pipes insulation	Fully insulated primary pipework	
<b>30.0 Solar Panel</b>		
Solar Panel Area	3.76	m <sup>2</sup>
Area Type	Aperture	
Panel Type	Flat plate, glazed	
n0, a1, a2, A/G ratio	0.75, 6.00, 0.0050, 0.90	
Orientation	South West	
Elevation	30°	
Overshading	Modest	
Solar Storage Volume	150.00	L
Pump electrically powered	No	
Combined Cylinder	Yes	
<b>31.0 Thermal Store</b>	None	

### Recommendations

#### Lower cost measures

None

#### Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£402	B 89	

# U-VALUE CALCULATOR REPORT

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## Building Elements

### Roof 000001 - Pitched roof - insulated at ceiling

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 (%)	Density (kg/m <sup>3</sup> )	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	<b>Roof space</b>						
	Main construction	0	0.2000	0.2000	100.00		
Layer 2	<b>Mineral wool</b>						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 3	<b>Mineral wool</b>						
	Main construction	150	0.0400	3.7500	100.00		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 4	<b>Mineral wool quilt</b>						
	Main construction	150	0.0400	3.7500	87.50		
	Main construction	150	0.1300	1.1538	12.50		
	Corrections - Air Gap: Level 0, Fasteners: None or plastic						
Layer 5	<b>Plasterboard, standard</b>						
	Main construction	15	0.2100	0.0714	100.00	700	1000
Int surface				0.1000			

Total resistance: Upper limit = 11.258 m<sup>2</sup> K/W Lower limit = 10.838 m<sup>2</sup> K/W Average = 11.048 m<sup>2</sup> K/W  
 Total correction = 0.0030 m<sup>2</sup> K/W U-value (unrounded) = 0.09 W/m<sup>2</sup> K

Unheated space: None

Total thickness: 465 mm

U-value: 0.09 W/m<sup>2</sup> K

Kappa: 10.50 kJ/m<sup>2</sup> K

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## Building Elements

### Floor SOG - 150mm PIR - floor - slab-on-ground floor

Floor Type: Slab On Ground Floor

Area = 129.09 m<sup>2</sup>, Perimeter = 48.85 m, Wall thickness = 330.00 mm, Soil: Clay

Horizontal edge insulation: none

Vertical edge insulation: Width D = 75.0 mm, Thickness dn = 25.0 mm, Lambda = 0.023

Layer	Description	Thickness (mm)	Conductivity (W/m <sup>2</sup> K)	Resistance (m <sup>2</sup> K/W)	Fraction (%)	Density (kg/m <sup>3</sup> )	Heat Cap. (J/kgK)
Ext surface				0.0400			
Layer 1	<b>Thermafloor TF70 zero ODP</b>						
	Main construction	150	0.0220	6.8182	100.00		
	Corrections - Air Gap: Level 1, Fasteners: None or plastic						
Layer 2	<b>Screed</b>						
	Main construction	65	1.1500	0.0565	100.00	1800	1000
Int surface				0.1700			

Total resistance: Upper limit = 6.875 m<sup>2</sup> K/W Lower limit = 6.875 m<sup>2</sup> K/W Average = 6.875 m<sup>2</sup> K/W

Total correction = 0.0098 m<sup>2</sup> K/W

U-value (unrounded) = 0.11 W/m<sup>2</sup> K

Unheated space: None

**Total thickness: 215 mm**

**U-value: 0.11 W/m<sup>2</sup> K**

**Kappa: 117.00 kJ/m<sup>2</sup> K**

# FULL SAP CALCULATION PRINTOUT

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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	129.0900 (1b)	x 2.5000 (2b)	= 322.7250 (1b) - (3b)
First floor	123.8000 (1c)	x 3.1000 (2c)	= 383.7800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	252.8900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 706.5050 (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				0 * 10 =	0.0000 (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)				0.0000 / (5) =	0.0000 (8)								
Pressure test				Yes									
Measured/design AP50				6.0000									
Infiltration rate				0.3000	(18)								
Number of sides sheltered				2	(19)								
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)								
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2550 (21)								
Wind speed	Jan 7.0000	Feb 6.6000	Mar 6.3000	Apr 5.5000	May 5.5000	Jun 5.0000	Jul 4.9000	Aug 4.9000	Sep 5.4000	Oct 6.3000	Nov 6.6000	Dec 7.0000	(22)
Wind factor	1.7500	1.6500	1.5750	1.3750	1.3750	1.2500	1.2250	1.2250	1.3500	1.5750	1.6500	1.7500	(22a)
Adj infiltr rate	0.4463	0.4208	0.4016	0.3506	0.3506	0.3188	0.3124	0.3124	0.3443	0.4016	0.4208	0.4463	(22b)
Balanced mechanical ventilation with heat recovery													
If mechanical ventilation:													0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =													79.0500 (23c)
Effective ac	0.5510	0.5255	0.5064	0.4554	0.4554	0.4235	0.4171	0.4171	0.4490	0.5064	0.5255	0.5510	(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
New Glazing (Uw = 1.40)			59.9700	1.3258	79.5057		(27)
Solid Doors			2.1500	1.1000	2.3650		(26)
Half Glazed Door			3.8000	1.5000	5.7000		(26a)
rooftlights (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)
Ground Floor - 150mm pIR			129.0900	0.1100	14.1999	117.0000	15103.5300 (28a)
External Wall	244.1800	65.9200	178.2600	0.1800	32.0868	9.0000	1604.3400 (29a)
Insulated Sloping Rafter	127.3200	1.8400	125.4800	0.1600	20.0768	9.0000	1129.3200 (30)
Insulated Ceiling - 450mm	25.6500		25.6500	0.0900	2.3085	10.5000	269.3250 (30)
Flat Roof Bay/Entrance	3.9900		3.9900	0.1800	0.7182	9.0000	35.9100 (30)
Total net area of external elements Aum(A, m <sup>2</sup> )			530.2300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	159.4003		(33)
GF x 2.5 FF x 2.85			415.9100			9.0000	3743.1900 (32c)
FF Floor			123.8000			18.0000	2228.4000 (32d)
GF Ceiling			129.0900			18.0000	2323.6200 (32e)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat capacity  $C_m = \text{Sum}(A \times k)$  (28)...(30) + (32) + (32a)...(32e) = 26437.6350 (34)  
 Thermal mass parameter (TMP =  $C_m / \text{TFA}$ ) in  $\text{kJ/m}^2\text{K}$  104.5420 (35)  
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 21.5213 (36)  
 Total fabric heat loss (33) + (36) = 180.9216 (37)

Ventilation heat loss calculated monthly (38)m =  $0.33 \times (25)\text{m} \times (5)$

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	128.4638	122.5186	118.0596	106.1692	106.1692	98.7376	97.2513	97.2513	104.6828	118.0596	122.5186	128.4638
Heat transfer coeff	309.3854	303.4401	298.9812	287.0907	287.0907	279.6592	278.1729	278.1729	285.6044	298.9812	303.4401	309.3854
Average = $\text{Sum}(39)\text{m} / 12 =$												
HLP	1.2234	1.1999	1.1823	1.1352	1.1352	1.1059	1.1000	1.1000	1.1294	1.1823	1.1999	1.2234
HLP (average)												1.1597
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

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

Assumed occupancy 3.0707 (42)  
 Average daily hot water use (litres/day) 107.1288 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	117.8417	113.5565	109.2714	104.9862	100.7011	96.4159	96.4159	100.7011	104.9862	109.2714	113.5565	117.8417
Energy content (annual)	174.7558	152.8426	157.7198	137.5040	131.9383	113.8528	105.5013	121.0643	122.5102	142.7738	155.8488	169.2417
Distribution loss (46)m = $0.15 \times (45)\text{m}$	26.2134	22.9264	23.6580	20.6256	19.7908	17.0779	15.8252	18.1596	18.3765	21.4161	23.3773	25.3863
Water storage loss:												
Store volume												300.0000
a) If manufacturer declared loss factor is known (kWh/day):												1.8900
Temperature factor from Table 2b												0.5400
Enter (49) or (54) in (55)												1.0206
Total storage loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386
If cylinder contains dedicated solar storage												
Primary loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624
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
Output from w/h	229.6568	202.4306	212.6208	190.6340	186.8393	166.9828	160.4023	175.9653	175.6402	197.6748	208.9788	224.1427
RHI water heating demand												
Heat gains from water heating, kWh/month	102.0271	90.4906	96.3626	88.2241	87.7903	80.3600	79.0000	84.1747	83.2386	91.3931	94.3237	100.1937
Total per year (kWh/year) = $\text{Sum}(64)\text{m} =$												2332

#### 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	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.3609	82.9224	67.4370	51.0541	38.1636	32.2193	34.8141	45.2527	60.7380	77.1209	90.0115	95.9557
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.2094	631.6971	615.3483	580.5435	536.6088	495.3163	467.7304	461.2427	477.5916	512.3963	556.3310	597.6235
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948
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
Losses e.g. evaporation (negative values) (Table 5)	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275
Water heating gains (Table 5)	137.1332	134.6586	129.5197	122.5334	117.9977	111.6112	106.1828	113.1380	115.6092	122.8402	131.0052	134.6689
Total internal gains	976.6121	970.1866	933.2135	875.0397	813.6786	760.0554	729.6359	740.5420	774.8474	833.2659	898.2562	949.1567

#### 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	5.4100	15.4538	0.6300	0.7000	0.7700	25.5508 (75)						
Southeast	14.4400	47.2368	0.6300	0.7000	0.7700	208.4585 (77)						
Southwest	11.1000	47.2368	0.6300	0.7000	0.7700	160.2416 (79)						
Northwest	29.0200	15.4538	0.6300	0.7000	0.7700	137.0581 (81)						
Southeast	0.9200	51.9931	0.6300	0.7000	1.0000	18.9852 (82)						
Northwest	0.9200	23.2399	0.6300	0.7000	1.0000	8.4860 (82)						
Solar gains	558.7802	870.1930	1319.1482	1902.8932	2215.9138	2437.8694	2060.9692	1911.7331	1543.5213	1011.8756	655.7823	485.6181
Total gains	1535.3923	1840.3796	2252.3616	2777.9328	3029.5924	3197.9248	2790.6051	2652.2750	2318.3686	1845.1415	1554.0385	1434.7748

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF HEAT DEMAND 09 Jan 2014

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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	23.7367	24.2018	24.5627	25.5800	25.5800	26.2598	26.4001	26.4001	25.7131	24.5627	24.2018	23.7367
alpha	2.5824	2.6135	2.6375	2.7053	2.7053	2.7507	2.7600	2.7600	2.7142	2.6375	2.6135	2.5824
util living area	0.9552	0.9331	0.8827	0.7811	0.6654	0.5034	0.4280	0.4304	0.6065	0.8288	0.9267	0.9588 (86)
MIT	19.4388	19.6136	19.9449	20.3588	20.6212	20.8081	20.8581	20.8594	20.7563	20.3820	19.8886	19.4553 (87)
Th 2	19.9013	19.9201	19.9342	19.9722	19.9722	19.9961	20.0009	20.0009	19.9769	19.9342	19.9201	19.9013 (88)
util rest of house	0.9469	0.9214	0.8631	0.7481	0.6165	0.4383	0.3450	0.3431	0.5300	0.7887	0.9106	0.9508 (89)
MIT 2	17.8559	18.1170	18.5940	19.1875	19.5291	19.7707	19.8286	19.8306	19.7072	19.2118	18.5173	17.8810 (90)
Living area fraction									fLA = Living area / (4) =			0.2899 (91)
MIT	18.3148	18.5509	18.9856	19.5270	19.8457	20.0714	20.1270	20.1289	20.0113	19.5510	18.9148	18.3374 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3148	18.5509	18.9856	19.5270	19.8457	20.0714	20.1270	20.1289	20.0113	19.5510	18.9148	18.3374 (93)

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#### 8. Space heating requirement

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9307	0.9023	0.8419	0.7320	0.6100	0.4434	0.3560	0.3547	0.5327	0.7715	0.8913	0.9353 (94)
Useful gains	1429.0261	1660.5345	1896.3208	2033.5327	1848.0448	1418.0230	993.3271	940.8682	1235.1090	1423.4504	1385.0875	1341.9902 (95)
Ext temp.	6.9000	7.0000	8.1000	9.8000	12.1000	14.6000	16.4000	16.6000	15.1000	12.5000	9.7000	7.3000 (96)
Heat loss rate W	3531.5575	3504.9926	3254.5883	2792.5427	2223.7131	1530.1407	1036.7503	981.6318	1402.6831	2108.1159	2796.1450	3414.8028 (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	1564.2833	1239.4758	1010.5511	546.4872	279.4972	0.0000	0.0000	0.0000	0.0000	509.3911	1015.9614	1542.1725 (98)
Space heating												7707.8198 (98)
RHI space heating demand												7708 (98)

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	129.0900 (1b)	x 2.5000 (2b)	= 322.7250 (1b) - (3b)
First floor	123.8000 (1c)	x 3.1000 (2c)	= 383.7800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	252.8900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 706.5050 (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					0 * 10 = 0.0000 (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) =					0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					6.0000							
Infiltration rate					0.3000 (18)							
Number of sides sheltered					2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2550 (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	0.3251	0.3188	0.3124	0.2805	0.2741	0.2423	0.2423	0.2359	0.2550	0.2741	0.2869	0.2996 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.4299	0.4235	0.4171	0.3853	0.3789	0.3470	0.3470	0.3406	0.3598	0.3789	0.3916	0.4044 (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					
New Glazing (Uw = 1.40)			59.9700	1.3258	79.5057		(27)					
Solid Doors			2.1500	1.1000	2.3650		(26)					
Half Glazed Door			3.8000	1.5000	5.7000		(26a)					
rooflights (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)					
Ground Floor - 150mm pIR			129.0900	0.1100	14.1999	117.0000	15103.5300 (28a)					
External Wall	244.1800	65.9200	178.2600	0.1800	32.0868	9.0000	1604.3400 (29a)					
Insulated Sloping Rafter	127.3200	1.8400	125.4800	0.1600	20.0768	9.0000	1129.3200 (30)					
Insulated Ceiling - 450mm	25.6500		25.6500	0.0900	2.3085	10.5000	269.3250 (30)					
Flat Roof Bay/Entrance	3.9900		3.9900	0.1800	0.7182	9.0000	35.9100 (30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			530.2300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	159.4003		(33)					
GF x 2.5 FF x 2.85			415.9100			9.0000	3743.1900 (32c)					
FF Floor			123.8000			18.0000	2228.4000 (32d)					
GF Ceiling			129.0900			18.0000	2323.6200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26437.6350 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m <sup>2</sup> K							104.5420 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.5213 (36)					
Total fabric heat loss						(33) + (36) =	180.9216 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 100.2239	Feb 98.7376	Mar 97.2513	Apr 89.8197	May 88.3334	Jun 80.9019	Jul 80.9019	Aug 79.4156	Sep 83.8745	Oct 88.3334	Nov 91.3061	Dec 94.2787 (38)
Heat transfer coeff	281.1455	279.6592	278.1729	270.7413	269.2550	261.8235	261.8235	260.3372	264.7961	269.2550	272.2276	275.2003 (39)
Average = Sum(39)m / 12 =												270.3697 (39)
HLP	Jan 1.1117	Feb 1.1059	Mar 1.1000	Apr 1.0706	May 1.0647	Jun 1.0353	Jul 1.0353	Aug 1.0294	Sep 1.0471	Oct 1.0647	Nov 1.0765	Dec 1.0882 (40)
HLP (average)												1.0691 (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	3.0707 (42)
Average daily hot water use (litres/day)	107.1288 (43)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	117.8417	113.5565	109.2714	104.9862	100.7011	96.4159	96.4159	100.7011	104.9862	109.2714	113.5565	117.8417	(44)	
Energy conte	174.7558	152.8426	157.7198	137.5040	131.9383	113.8528	105.5013	121.0643	122.5102	142.7738	155.8488	169.2417	(45)	
Energy content (annual)	Total = Sum(45)m =												1685.5534	(45)
Distribution loss (46)m = 0.15 x (45)m	26.2134	22.9264	23.6580	20.6256	19.7908	17.0779	15.8252	18.1596	18.3765	21.4161	23.3773	25.3863	(46)	
Water storage loss:														
Store volume													300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8900	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.0206	(55)
Total storage loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)	
If cylinder contains dedicated solar storage	15.8193	14.2884	15.8193	15.3090	15.8193	15.3090	15.8193	15.8193	15.3090	15.8193	15.3090	15.8193	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	213.8375	188.1422	195.4058	168.5714	158.2257	139.0670	131.5561	148.0496	154.9283	180.4598	193.6698	208.3234	(62)	
Aperture area of solar collector													3.7600	(H1)
Zero-loss collector efficiency													0.7500	(H2)
Collector effective heat loss coefficient													6.0000	(H3b)
Collector performance ratio													8.0000	(H4)
Annual solar radiation per m2													1029.1867	(H5)
Overshading factor													0.8000	(H6)
Solar energy available													2321.8452	(H7)
Adjustment factor for showers													1.2900	(H7a)
Solar-to-load ratio													1.0678	(H8)
Utilisation factor													0.6080	(H9)
Collector performance factor													0.7148	(H10)
Dedicated solar storage volume													150.0000	(H11)
Effective solar volume													195.0000	(H13)
Daily hot water demand													107.1288	(H14)
Volume ratio Veff/V													1.8202	(H15)
Solar storage volume factor													1.0000	(H16)
Solar input													-1009.0621	(H17)
Solar input	-27.0122	-46.3071	-81.6043	-112.4710	-141.0027	-139.3103	-137.1928	-118.6202	-90.8268	-59.9937	-32.2959	-22.4252	(63)	
Solar input (sum of months) = Sum(63)m =													-1009.0621	(63)
Output from w/h	186.8253	141.8351	113.8015	56.1004	17.2230	0.0000	0.0000	29.4294	64.1015	120.4660	161.3739	185.8982	(64)	
Total per year (kWh/year) = Sum(64)m =													1077.0543	(64)
Heat gains from water heating, kWh/month	89.3717	79.0598	82.5906	70.5740	64.8994	58.0275	55.9230	61.8421	66.6691	77.6211	82.0765	87.5382	(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	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.3609	82.9224	67.4370	51.0541	38.1636	32.2193	34.8141	45.2527	60.7380	77.1209	90.0115	95.9557	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.2094	631.6971	615.3483	580.5435	536.6088	495.3163	467.7304	461.2427	477.5916	512.3963	556.3310	597.6235	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	(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)	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	(71)
Water heating gains (Table 5)	120.1232	117.6486	111.0089	98.0194	87.2304	80.5937	75.1653	83.1211	92.5960	104.3294	113.9952	117.6589	(72)
Total internal gains	959.6021	953.1766	914.7027	850.5257	782.9113	729.0379	698.6184	710.5250	751.8342	814.7551	881.2462	932.1467	(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	5.4100	11.2829	0.6300	0.7000	0.7700	18.6548 (75)							
Southeast	14.4400	36.7938	0.6300	0.7000	0.7700	162.3731 (77)							
Southwest	11.1000	36.7938	0.6300	0.7000	0.7700	124.8159 (79)							
Northwest	29.0200	11.2829	0.6300	0.7000	0.7700	100.0672 (81)							
Southeast	0.9200	39.2172	0.6300	0.7000	1.0000	14.3201 (82)							
Northwest	0.9200	16.8560	0.6300	0.7000	1.0000	6.1549 (82)							
Solar gains	426.3860	770.2054	1169.5467	1641.5806	2013.2819	2075.2216	1968.9213	1680.1126	1331.3011	882.5307	518.7313	359.6964	(83)
Total gains	1385.9880	1723.3820	2084.2494	2492.1062	2796.1932	2804.2595	2667.5397	2390.6376	2083.1352	1697.2858	1399.9775	1291.8431	(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	26.1210	26.2598	26.4001	27.1247	27.2745	28.0486	28.0486	28.2088	27.7337	27.2745	26.9766	26.6852		
alpha	2.7414	2.7507	2.7600	2.8083	2.8183	2.8699	2.8699	2.8806	2.8489	2.8183	2.7984	2.7790		
util living area	0.9749	0.9548	0.9148	0.8285	0.6961	0.5340	0.4089	0.4643	0.6899	0.8873	0.9601	0.9790	(86)	
MIT	19.1549	19.4066	19.7869	20.2624	20.6086	20.8108	20.8735	20.8596	20.6973	20.2174	19.6137	19.1343	(87)	
Th 2	19.9913	19.9961	20.0009	20.0249	20.0298	20.0540	20.0540	20.0589	20.0443	20.0298	20.0201	20.0105	(88)	



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

util rest of house	0.9709	0.9479	0.9016	0.8028	0.6523	0.4703	0.3288	0.3810	0.6297	0.8643	0.9529	0.9757 (89)
MIT 2	17.5016	17.8684	18.4167	19.0998	19.5643	19.8312	19.8954	19.8894	19.7008	19.0563	18.1884	17.4846 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	17.9809	18.3143	18.8139	19.4368	19.8671	20.1151	20.1790	20.1707	19.9897	19.3929	18.6015	17.9628 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.9809	18.3143	18.8139	19.4368	19.8671	20.1151	20.1790	20.1707	19.9897	19.3929	18.6015	17.9628 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9602	0.9327	0.8825	0.7850	0.6443	0.4747	0.3398	0.3914	0.6259	0.8460	0.9390	0.9663 (94)
Useful gains	1330.7642	1607.4529	1839.3053	1956.3578	1801.5987	1331.0808	906.3331	935.6425	1303.7857	1435.8479	1314.5865	1248.2562 (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	3846.3149	3751.4307	3425.3865	2852.7482	2199.0240	1443.9936	937.0619	981.6456	1559.5718	2367.5320	3131.0397	3787.5304 (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	1871.5697	1440.7531	1180.0444	645.4011	295.6844	0.0000	0.0000	0.0000	0.0000	693.1729	1307.8463	1889.2200 (98)
Space heating	9323.6919 (98)											
Space heating per m2	(98) / (4) = 36.8686 (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)													0.1000 (201)
Fraction of space heat from main system(s)													0.9000 (202)
Efficiency of main space heating system 1 (in %)													90.3000 (206)
Efficiency of secondary/supplementary heating system, %													65.0000 (208)
Space heating requirement													9292.7162 (211)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1871.5697	1440.7531	1180.0444	645.4011	295.6844	0.0000	0.0000	0.0000	0.0000	693.1729	1307.8463	1889.2200 (98)	
Space heating efficiency (main heating system 1)	90.3000	90.3000	90.3000	90.3000	90.3000	0.0000	0.0000	0.0000	0.0000	90.3000	90.3000	90.3000 (210)	
Space heating fuel (main heating system)	1865.3519	1435.9665	1176.1240	643.2569	294.7021	0.0000	0.0000	0.0000	0.0000	690.8700	1303.5012	1882.9436 (211)	
Water heating requirement	287.9338	221.6543	181.5453	99.2925	45.4899	0.0000	0.0000	0.0000	0.0000	106.6420	201.2071	290.6492 (215)	
Water heating requirement	186.8253	141.8351	113.8015	56.1004	17.2230	0.0000	0.0000	29.4294	64.1015	120.4660	161.3739	185.8982 (64)	
Efficiency of water heater (217)m	89.1042	89.1188	89.1403	89.2434	89.5681	79.6000	79.6000	79.6000	79.6000	88.3773	88.8598	89.1193 (217)	
Fuel for water heating, kWh/month	209.6707	159.1528	127.6656	62.8622	19.2289	0.0000	0.0000	36.9716	80.5295	136.3088	181.6050	208.5948 (219)	
Water heating fuel used	1222.5899 (219)												
Annual totals kWh/year													
Space heating fuel - main system	9292.7162 (211)												
Space heating fuel - secondary	1434.4141 (215)												
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3000)													
mechanical ventilation fans (SFP = 1.3000)													1120.5169 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													1195.5169 (231)
Electricity for lighting (calculated in Appendix L)													659.5133 (232)
Total delivered energy for all uses													13804.7505 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	9292.7162	3.4800	323.3865 (240)
Space heating - secondary	1434.4141	4.2300	60.6757 (242)
Water heating (other fuel)	1222.5899	3.4800	42.5461 (247)
Mechanical ventilation fans	1120.5169	13.1900	147.7962 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	659.5133	13.1900	86.9898 (250)
Additional standing charges			120.0000 (251)
Total energy cost			791.2869 (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] =		1.1156 (257)
SAP value			84.4367
SAP rating (Section 12)			84 (258)
SAP band			B

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	9292.7162	0.2160	2007.2267 (261)
Space heating - secondary	1434.4141	0.0190	27.2539 (263)
Water heating (other fuel)	1222.5899	0.2160	264.0794 (264)
Space and water heating			2298.5600 (265)
Pumps and fans	1195.5169	0.5190	620.4733 (267)
Energy for lighting	659.5133	0.5190	342.2874 (268)
Total kg/year			3261.3207 (272)
CO2 emissions per m2			12.9000 (273)
EI value			85.3296
EI rating			B (274)
EI band			B

-----  
 Calculation of stars for heating and DHW  
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Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.9030 = 4.133$ , stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.9030 = 0.2565$ , stars = 4
Water heating energy efficiency	$3.48 / 0.8591 = 4.051$ , stars = 5
Water heating environmental impact	$0.216 / 0.8591 = 0.2514$ , stars = 5

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# 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 (m2)	Storey height (m)	Volume (m3)
Ground floor	129.0900 (1b)	2.5000 (2b)	322.7250 (1b) - (3b)
First floor	123.8000 (1c)	3.1000 (2c)	383.7800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	252.8900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 706.5050 (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				0 * 10 =	0.0000 (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) =				0.0000 / (5) =	0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					6.0000							
Infiltration rate					0.3000 (18)							
Number of sides sheltered					2 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2550 (21)							
Wind speed	Jan 7.0000	Feb 6.6000	Mar 6.3000	Apr 5.5000	May 5.5000	Jun 5.0000	Jul 4.9000	Aug 4.9000	Sep 5.4000	Oct 6.3000	Nov 6.6000	Dec 7.0000 (22)
Wind factor	1.7500	1.6500	1.5750	1.3750	1.3750	1.2500	1.2250	1.2250	1.3500	1.5750	1.6500	1.7500 (22a)
Adj infilt rate	0.4463	0.4208	0.4016	0.3506	0.3506	0.3188	0.3124	0.3124	0.3443	0.4016	0.4208	0.4463 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.5510	0.5255	0.5064	0.4554	0.4554	0.4235	0.4171	0.4171	0.4490	0.5064	0.5255	0.5510 (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					
New Glazing (Uw = 1.40)			59.9700	1.3258	79.5057		(27)					
Solid Doors			2.1500	1.1000	2.3650		(26)					
Half Glazed Door			3.8000	1.5000	5.7000		(26a)					
rooflights (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)					
Ground Floor - 150mm pIR			129.0900	0.1100	14.1999	117.0000	15103.5300 (28a)					
External Wall	244.1800	65.9200	178.2600	0.1800	32.0868	9.0000	1604.3400 (29a)					
Insulated Sloping Rafter	127.3200	1.8400	125.4800	0.1600	20.0768	9.0000	1129.3200 (30)					
Insulated Ceiling - 450mm	25.6500		25.6500	0.0900	2.3085	10.5000	269.3250 (30)					
Flat Roof Bay/Entrance	3.9900		3.9900	0.1800	0.7182	9.0000	35.9100 (30)					
Total net area of external elements Aum(A, m2)			530.2300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	159.4003		(33)					
GF x 2.5 FF x 2.85			415.9100			9.0000	3743.1900 (32c)					
FF Floor			123.8000			18.0000	2228.4000 (32d)					
GF Ceiling			129.0900			18.0000	2323.6200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26437.6350 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							104.5420 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.5213 (36)					
Total fabric heat loss						(33) + (36) =	180.9216 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 128.4638	Feb 122.5186	Mar 118.0596	Apr 106.1692	May 106.1692	Jun 98.7376	Jul 97.2513	Aug 97.2513	Sep 104.6828	Oct 118.0596	Nov 122.5186	Dec 128.4638 (38)
Heat transfer coeff	309.3854	303.4401	298.9812	287.0907	287.0907	279.6592	278.1729	278.1729	285.6044	298.9812	303.4401	309.3854 (39)
Average = Sum(39)m / 12 =												293.2837 (39)
HLP	Jan 1.2234	Feb 1.1999	Mar 1.1823	Apr 1.1352	May 1.1352	Jun 1.1059	Jul 1.1000	Aug 1.1000	Sep 1.1294	Oct 1.1823	Nov 1.1999	Dec 1.2234 (40)
HLP (average)												1.1597 (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	3.0707 (42)
Average daily hot water use (litres/day)	107.1288 (43)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	117.8417	113.5565	109.2714	104.9862	100.7011	96.4159	96.4159	100.7011	104.9862	109.2714	113.5565	117.8417	(44)	
Energy conte	174.7558	152.8426	157.7198	137.5040	131.9383	113.8528	105.5013	121.0643	122.5102	142.7738	155.8488	169.2417	(45)	
Energy content (annual)	Total = Sum(45)m =												1685.5534	(45)
Distribution loss (46)m = 0.15 x (45)m	26.2134	22.9264	23.6580	20.6256	19.7908	17.0779	15.8252	18.1596	18.3765	21.4161	23.3773	25.3863	(46)	
Water storage loss:														
Store volume													300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8900	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.0206	(55)
Total storage loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)	
If cylinder contains dedicated solar storage	15.8193	14.2884	15.8193	15.3090	15.8193	15.3090	15.8193	15.8193	15.3090	15.8193	15.3090	15.8193	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	213.8375	188.1422	195.4058	168.5714	158.2257	139.0670	131.5561	148.0496	154.9283	180.4598	193.6698	208.3234	(62)	
Aperture area of solar collector													3.7600	(H1)
Zero-loss collector efficiency													0.7500	(H2)
Collector effective heat loss coefficient													6.0000	(H3b)
Collector performance ratio													8.0000	(H4)
Annual solar radiation per m2													1176.5711	(H5)
Overshading factor													0.8000	(H6)
Solar energy available													2654.3443	(H7)
Adjustment factor for showers													1.2900	(H7a)
Solar-to-load ratio													1.2207	(H8)
Utilisation factor													0.5592	(H9)
Collector performance factor													0.7148	(H10)
Dedicated solar storage volume													150.0000	(H11)
Effective solar volume													195.0000	(H13)
Daily hot water demand													107.1288	(H14)
Volume ratio Veff/V													1.8202	(H15)
Solar storage volume factor													1.0000	(H16)
Solar input													-1060.9908	(H17)
Solar input	-33.2146	-48.8843	-85.2766	-119.6926	-141.8166	-149.3827	-131.1346	-123.6197	-97.1829	-64.0855	-38.2699	-28.4308	(63)	
Solar input (sum of months) = Sum(63)m =													-1060.9908	(63)
Output from w/h	180.6229	139.2579	110.1292	48.8788	16.4091	0.0000	0.4215	24.4299	57.7454	116.3742	155.3999	179.8926	(64)	
Total per year (kWh/year) = Sum(64)m =													1029.5614	(64)
Heat gains from water heating, kWh/month	89.3717	79.0598	82.5906	70.5740	64.8994	58.0275	55.9230	61.8421	66.6691	77.6211	82.0765	87.5382	(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	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.3609	82.9224	67.4370	51.0541	38.1636	32.2193	34.8141	45.2527	60.7380	77.1209	90.0115	95.9557	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.2094	631.6971	615.3483	580.5435	536.6088	495.3163	467.7304	461.2427	477.5916	512.3963	556.3310	597.6235	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	(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)	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	(71)
Water heating gains (Table 5)	120.1232	117.6486	111.0089	98.0194	87.2304	80.5937	75.1653	83.1211	92.5960	104.3294	113.9952	117.6589	(72)
Total internal gains	959.6021	953.1766	914.7027	850.5257	782.9113	729.0379	698.6184	710.5250	751.8342	814.7551	881.2462	932.1467	(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 Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	5.4100	15.4538	0.6300	0.6300	0.7000	0.7700	25.5508	(75)					
Southeast	14.4400	47.2368	0.6300	0.6300	0.7000	0.7700	208.4585	(77)					
Southwest	11.1000	47.2368	0.6300	0.6300	0.7000	0.7700	160.2416	(79)					
Northwest	29.0200	15.4538	0.6300	0.6300	0.7000	0.7700	137.0581	(81)					
Southeast	0.9200	51.9931	0.6300	0.6300	0.7000	1.0000	18.9852	(82)					
Northwest	0.9200	23.2399	0.6300	0.6300	0.7000	1.0000	8.4860	(82)					
Solar gains	558.7802	870.1930	1319.1482	1902.8932	2215.9138	2437.8694	2060.9692	1911.7331	1543.5213	1011.8756	655.7823	485.6181	(83)
Total gains	1518.3823	1823.3696	2233.8508	2753.4188	2998.8251	3166.9073	2759.5876	2622.2581	2295.3554	1826.6307	1537.0285	1417.7648	(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	23.7367	24.2018	24.5627	25.5800	25.5800	26.2598	26.4001	26.4001	25.7131	24.5627	24.2018	23.7367		
alpha	2.5824	2.6135	2.6375	2.7053	2.7053	2.7507	2.7600	2.7600	2.7142	2.6375	2.6135	2.5824		
util living area	0.9563	0.9343	0.8845	0.7840	0.6694	0.5072	0.4321	0.4345	0.6106	0.8316	0.9283	0.9599	(86)	
MIT	19.4314	19.6067	19.9386	20.3530	20.6168	20.8063	20.8570	20.8584	20.7538	20.3768	19.8819	19.4478	(87)	
Th 2	19.9013	19.9201	19.9342	19.9722	19.9722	19.9961	20.0009	20.0009	19.9769	19.9342	19.9201	19.9013	(88)	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

util rest of house	0.9481	0.9228	0.8651	0.7512	0.6206	0.4419	0.3486	0.3466	0.5339	0.7919	0.9125	0.9520 (89)
MIT 2	17.8454	18.1073	18.5853	19.1801	19.5240	19.7690	19.8278	19.8299	19.7048	19.2052	18.5079	17.8704 (90)
Living area fraction									fLA = Living area / (4) =			0.2899 (91)
MIT	18.3052	18.5420	18.9776	19.5201	19.8408	20.0697	20.1261	20.1280	20.0089	19.5448	18.9062	18.3277 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3052	18.5420	18.9776	19.5201	19.8408	20.0697	20.1261	20.1280	20.0089	19.5448	18.9062	18.3277 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9321	0.9038	0.8439	0.7350	0.6139	0.4469	0.3595	0.3583	0.5365	0.7745	0.8933	0.9368 (94)
Useful gains	1415.3469	1648.0489	1885.1844	2023.7386	1840.8347	1415.3524	992.0120	939.6082	1231.5315	1414.7403	1373.0246	1328.1122 (95)
Ext temp.	6.9000	7.0000	8.1000	9.8000	12.1000	14.6000	16.4000	16.6000	15.1000	12.5000	9.7000	7.3000 (96)
Heat loss rate W												
3528.5873	3502.2965	3252.2056	2790.5581	2222.3153	1529.6567	1036.5121	981.4024	1402.0044	2106.2749	2793.5358	3411.7941 (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	1572.2508	1246.0544	1017.0637	552.1100	283.8216	0.0000	0.0000	0.0000	0.0000	514.5017	1022.7681	1550.2594 (98)
Space heating												7758.8297 (98)
Space heating per m2												(98) / (4) = 30.6807 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.3000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												7733.0529 (211)
Space heating requirement	1572.2508	1246.0544	1017.0637	552.1100	283.8216	0.0000	0.0000	0.0000	0.0000	514.5017	1022.7681	1550.2594 (98)
Space heating efficiency (main heating system 1)	90.3000	90.3000	90.3000	90.3000	90.3000	0.0000	0.0000	0.0000	0.0000	90.3000	90.3000	90.3000 (210)
Space heating fuel (main heating system)	1567.0274	1241.9146	1013.6848	550.2758	282.8786	0.0000	0.0000	0.0000	0.0000	512.7924	1019.3702	1545.1090 (211)
Water heating requirement	241.8847	191.7007	156.4713	84.9400	43.6649	0.0000	0.0000	0.0000	0.0000	79.1541	157.3489	238.5014 (215)
Water heating requirement	180.6229	139.2579	110.1292	48.8788	16.4091	0.0000	0.4215	24.4299	57.7454	116.3742	155.3999	179.8926 (64)
Efficiency of water heater (217)m	88.9466	88.9788	89.0150	89.2258	89.5732	79.6000	79.6000	79.6000	79.6000	87.9262	88.5802	88.9347 (217)
Fuel for water heating, kWh/month	203.0690	156.5068	123.7198	54.7809	18.3192	0.0000	0.5295	30.6908	72.5445	132.3545	175.4342	202.2751 (219)
Water heating fuel used												1170.2243 (219)
Annual totals kWh/year												
Space heating fuel - main system												7733.0529 (211)
Space heating fuel - secondary												1193.6661 (215)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3000)												
mechanical ventilation fans (SFP = 1.3000)												1120.5169 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												1195.5169 (231)
Electricity for lighting (calculated in Appendix L)												659.5133 (232)
Total delivered energy for all uses												11951.9735 (238)

#### 10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7733.0529	3.7400	289.2162 (240)
Space heating - secondary	1193.6661	5.5200	65.8904 (242)
Water heating (other fuel)	1170.2243	3.7400	43.7664 (247)
Mechanical ventilation fans	1120.5169	20.4300	228.9216 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	659.5133	20.4300	134.7386 (250)
Additional standing charges			95.0000 (251)
Total energy cost			872.8556 (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	7733.0529	0.2160	1670.3394 (261)
Space heating - secondary	1193.6661	0.0190	22.6797 (263)
Water heating (other fuel)	1170.2243	0.2160	252.7685 (264)
Space and water heating			1945.7875 (265)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Pumps and fans	1195.5169	0.5190	620.4733 (267)
Energy for lighting	659.5133	0.5190	342.2874 (268)
Total kg/year			2908.5482 (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	7733.0529	1.2200	9434.3245 (261)
Space heating - secondary	1193.6661	1.0400	1241.4128 (263)
Water heating (other fuel)	1170.2243	1.2200	1427.6737 (264)
Space and water heating			12103.4109 (265)
Pumps and fans	1195.5169	3.0700	3670.2370 (267)
Energy for lighting	659.5133	3.0700	2024.7059 (268)
Primary energy kWh/year			17798.3538 (272)
Primary energy kWh/m2/year			70.3798 (273)

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 SAP 2012 EPC IMPROVEMENTS  
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Current energy efficiency rating: B 84  
 Current environmental impact rating: B 85

(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	Already installed
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
U Solar photovoltaic panels	+ 4.5	-£ 402	-1020 kg (35.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£402	4.04 kg/m <sup>2</sup>	B 89 B 89
<b>Total Savings</b>	<b>£402</b>	<b>4.04 kg/m<sup>2</sup></b>	

Potential energy efficiency rating: B 89  
 Potential environmental impact rating: B 89

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 2022)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, South West England):

	Current	Potential	Saving
Electricity	£379	£379	£0
Mains gas	£428	£428	£0
Wood	£66	£66	£0
Space heating	£694	£694	£0
Water heating	£44	£44	£0
Lighting	£135	£135	£0
Generated (PV)	-£0	-£402	£402
Total cost of fuels	£873	£471	£402
Total cost of uses	£873	£471	£402
Delivered energy	47 kWh/m <sup>2</sup>	39 kWh/m <sup>2</sup>	8 kWh/m <sup>2</sup>
Carbon dioxide emissions	2.9 tonnes	1.9 tonnes	1.0 tonnes

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

CO2 emissions per m <sup>2</sup>	12 kg/m <sup>2</sup>	7 kg/m <sup>2</sup>	4 kg/m <sup>2</sup>
Primary energy	70 kWh/m <sup>2</sup>	47 kWh/m <sup>2</sup>	24 kWh/m <sup>2</sup>

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# 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	129.0900 (1b)	x 2.5000 (2b)	= 322.7250 (1b) - (3b)
First floor	123.8000 (1c)	x 3.1000 (2c)	= 383.7800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	252.8900		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 706.5050 (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					0 * 10 = 0.0000 (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)					0.0000 / (5) = 0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					6.0000							
Infiltration rate					0.3000 (18)							
Number of sides sheltered					2 (19)							
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)							
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2550 (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	0.3251	0.3188	0.3124	0.2805	0.2741	0.2423	0.2423	0.2359	0.2550	0.2741	0.2869	0.2996 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.4299	0.4235	0.4171	0.3853	0.3789	0.3470	0.3470	0.3406	0.3598	0.3789	0.3916	0.4044 (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					
New Glazing (Uw = 1.40)			59.9700	1.3258	79.5057		(27)					
Solid Doors			2.1500	1.1000	2.3650		(26)					
Half Glazed Door			3.8000	1.5000	5.7000		(26a)					
rooflights (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)					
Ground Floor - 150mm pIR			129.0900	0.1100	14.1999	117.0000	15103.5300 (28a)					
External Wall	244.1800	65.9200	178.2600	0.1800	32.0868	9.0000	1604.3400 (29a)					
Insulated Sloping Rafter	127.3200	1.8400	125.4800	0.1600	20.0768	9.0000	1129.3200 (30)					
Insulated Ceiling - 450mm	25.6500		25.6500	0.0900	2.3085	10.5000	269.3250 (30)					
Flat Roof Bay/Entrance	3.9900		3.9900	0.1800	0.7182	9.0000	35.9100 (30)					
Total net area of external elements Aum(A, m2)			530.2300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	159.4003		(33)					
GF x 2.5 FF x 2.85			415.9100			9.0000	3743.1900 (32c)					
FF Floor			123.8000			18.0000	2228.4000 (32d)					
GF Ceiling			129.0900			18.0000	2323.6200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26437.6350 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							104.5420 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.5213 (36)					
Total fabric heat loss						(33) + (36) =	180.9216 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 100.2239	Feb 98.7376	Mar 97.2513	Apr 89.8197	May 88.3334	Jun 80.9019	Jul 80.9019	Aug 79.4156	Sep 83.8745	Oct 88.3334	Nov 91.3061	Dec 94.2787 (38)
Heat transfer coeff	281.1455	279.6592	278.1729	270.7413	269.2550	261.8235	261.8235	260.3372	264.7961	269.2550	272.2276	275.2003 (39)
Average = Sum(39)m / 12 =												270.3697 (39)
HLP	Jan 1.1117	Feb 1.1059	Mar 1.1000	Apr 1.0706	May 1.0647	Jun 1.0353	Jul 1.0353	Aug 1.0294	Sep 1.0471	Oct 1.0647	Nov 1.0765	Dec 1.0882 (40)
HLP (average)												1.0691 (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	3.0707 (42)
Average daily hot water use (litres/day)	107.1288 (43)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	117.8417	113.5565	109.2714	104.9862	100.7011	96.4159	96.4159	100.7011	104.9862	109.2714	113.5565	117.8417	(44)	
Energy conte	174.7558	152.8426	157.7198	137.5040	131.9383	113.8528	105.5013	121.0643	122.5102	142.7738	155.8488	169.2417	(45)	
Energy content (annual)	Total = Sum(45)m =												1685.5534	(45)
Distribution loss (46)m = 0.15 x (45)m	26.2134	22.9264	23.6580	20.6256	19.7908	17.0779	15.8252	18.1596	18.3765	21.4161	23.3773	25.3863	(46)	
Water storage loss:														
Store volume													300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8900	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.0206	(55)
Total storage loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)	
If cylinder contains dedicated solar storage	15.8193	14.2884	15.8193	15.3090	15.8193	15.3090	15.8193	15.8193	15.3090	15.8193	15.3090	15.8193	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	213.8375	188.1422	195.4058	168.5714	158.2257	139.0670	131.5561	148.0496	154.9283	180.4598	193.6698	208.3234	(62)	
Aperture area of solar collector													3.7600	(H1)
Zero-loss collector efficiency													0.7500	(H2)
Collector effective heat loss coefficient													6.0000	(H3b)
Collector performance ratio													8.0000	(H4)
Annual solar radiation per m2													1029.1867	(H5)
Overshading factor													0.8000	(H6)
Solar energy available													2321.8452	(H7)
Adjustment factor for showers													1.2900	(H7a)
Solar-to-load ratio													1.0678	(H8)
Utilisation factor													0.6080	(H9)
Collector performance factor													0.7148	(H10)
Dedicated solar storage volume													150.0000	(H11)
Effective solar volume													195.0000	(H13)
Daily hot water demand													107.1288	(H14)
Volume ratio Veff/V													1.8202	(H15)
Solar storage volume factor													1.0000	(H16)
Solar input													-1009.0621	(H17)
Solar input	-27.0122	-46.3071	-81.6043	-112.4710	-141.0027	-139.3103	-137.1928	-118.6202	-90.8268	-59.9937	-32.2959	-22.4252	(63)	
Solar input (sum of months) = Sum(63)m =													-1009.0621	(63)
Output from w/h	186.8253	141.8351	113.8015	56.1004	17.2230	0.0000	0.0000	29.4294	64.1015	120.4660	161.3739	185.8982	(64)	
Total per year (kWh/year) = Sum(64)m =													1077.0543	(64)
Heat gains from water heating, kWh/month	89.3717	79.0598	82.5906	70.5740	64.8994	58.0275	55.9230	61.8421	66.6691	77.6211	82.0765	87.5382	(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	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.3609	82.9224	67.4370	51.0541	38.1636	32.2193	34.8141	45.2527	60.7380	77.1209	90.0115	95.9557	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.2094	631.6971	615.3483	580.5435	536.6088	495.3163	467.7304	461.2427	477.5916	512.3963	556.3310	597.6235	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	(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)	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	(71)
Water heating gains (Table 5)	120.1232	117.6486	111.0089	98.0194	87.2304	80.5937	75.1653	83.1211	92.5960	104.3294	113.9952	117.6589	(72)
Total internal gains	959.6021	953.1766	914.7027	850.5257	782.9113	729.0379	698.6184	710.5250	751.8342	814.7551	881.2462	932.1467	(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 Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	5.4100	11.2829	0.6300	0.7000	0.7700	18.6548	(75)						
Southeast	14.4400	36.7938	0.6300	0.7000	0.7700	162.3731	(77)						
Southwest	11.1000	36.7938	0.6300	0.7000	0.7700	124.8159	(79)						
Northwest	29.0200	11.2829	0.6300	0.7000	0.7700	100.0672	(81)						
Southeast	0.9200	39.2172	0.6300	0.7000	1.0000	14.3201	(82)						
Northwest	0.9200	16.8560	0.6300	0.7000	1.0000	6.1549	(82)						
Solar gains	426.3860	770.2054	1169.5467	1641.5806	2013.2819	2075.2216	1968.9213	1680.1126	1331.3011	882.5307	518.7313	359.6964	(83)
Total gains	1385.9880	1723.3820	2084.2494	2492.1062	2796.1932	2804.2595	2667.5397	2390.6376	2083.1352	1697.2858	1399.9775	1291.8431	(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	26.1210	26.2598	26.4001	27.1247	27.2745	28.0486	28.0486	28.2088	27.7337	27.2745	26.9766	26.6852		
alpha	2.7414	2.7507	2.7600	2.8083	2.8183	2.8699	2.8699	2.8806	2.8489	2.8183	2.7984	2.7790		
util living area	0.9749	0.9548	0.9148	0.8285	0.6961	0.5340	0.4089	0.4643	0.6899	0.8873	0.9601	0.9790	(86)	
MIT	19.1549	19.4066	19.7869	20.2624	20.6086	20.8108	20.8735	20.8596	20.6973	20.2174	19.6137	19.1343	(87)	
Th 2	19.9913	19.9961	20.0009	20.0249	20.0298	20.0540	20.0540	20.0589	20.0443	20.0298	20.0201	20.0105	(88)	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

util rest of house	0.9709	0.9479	0.9016	0.8028	0.6523	0.4703	0.3288	0.3810	0.6297	0.8643	0.9529	0.9757 (89)
MIT 2	17.5016	17.8684	18.4167	19.0998	19.5643	19.8312	19.8954	19.8894	19.7008	19.0563	18.1884	17.4846 (90)
Living area fraction									fLA = Living area / (4) =			0.2899 (91)
MIT	17.9809	18.3143	18.8139	19.4368	19.8671	20.1151	20.1790	20.1707	19.9897	19.3929	18.6015	17.9628 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9809	18.3143	18.8139	19.4368	19.8671	20.1151	20.1790	20.1707	19.9897	19.3929	18.6015	17.9628 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9602	0.9327	0.8825	0.7850	0.6443	0.4747	0.3398	0.3914	0.6259	0.8460	0.9390	0.9663 (94)
Useful gains	1330.7642	1607.4529	1839.3053	1956.3578	1801.5987	1331.0808	906.3331	935.6425	1303.7857	1435.8479	1314.5865	1248.2562 (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	3846.3149	3751.4307	3425.3865	2852.7482	2199.0240	1443.9936	937.0619	981.6456	1559.5718	2367.5320	3131.0397	3787.5304 (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	1871.5697	1440.7531	1180.0444	645.4011	295.6844	0.0000	0.0000	0.0000	0.0000	693.1729	1307.8463	1889.2200 (98)
Space heating												9323.6919 (98)
Space heating per m2												(98) / (4) = 36.8686 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.3000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												9292.7162 (211)
Space heating requirement	1871.5697	1440.7531	1180.0444	645.4011	295.6844	0.0000	0.0000	0.0000	0.0000	693.1729	1307.8463	1889.2200 (98)
Space heating efficiency (main heating system 1)	90.3000	90.3000	90.3000	90.3000	90.3000	0.0000	0.0000	0.0000	0.0000	90.3000	90.3000	90.3000 (210)
Space heating fuel (main heating system)	1865.3519	1435.9665	1176.1240	643.2569	294.7021	0.0000	0.0000	0.0000	0.0000	690.8700	1303.5012	1882.9436 (211)
Water heating requirement	287.9338	221.6543	181.5453	99.2925	45.4899	0.0000	0.0000	0.0000	0.0000	106.6420	201.2071	290.6492 (215)
Water heating requirement	186.8253	141.8351	113.8015	56.1004	17.2230	0.0000	0.0000	29.4294	64.1015	120.4660	161.3739	185.8982 (64)
Efficiency of water heater (217)m	89.1042	89.1188	89.1403	89.2434	89.5681	79.6000	79.6000	79.6000	79.6000	88.3773	88.8598	79.6000 (216)
Fuel for water heating, kWh/month	209.6707	159.1528	127.6656	62.8622	19.2289	0.0000	0.0000	36.9716	80.5295	136.3088	181.6050	208.5948 (219)
Water heating fuel used												1222.5899 (219)
Annual totals kWh/year												
Space heating fuel - main system												9292.7162 (211)
Space heating fuel - secondary												1434.4141 (215)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3000)												
mechanical ventilation fans (SFP = 1.3000)												1120.5169 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												1195.5169 (231)
Electricity for lighting (calculated in Appendix L)												659.5133 (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												12077.5111 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	9292.7162	3.4800	323.3865 (240)
Space heating - secondary	1434.4141	4.2300	60.6757 (242)
Water heating (other fuel)	1222.5899	3.4800	42.5461 (247)
Mechanical ventilation fans	1120.5169	13.1900	147.7962 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	659.5133	13.1900	86.9898 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			563.4640 (255)

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7944 (257)
SAP value		88.9176
SAP rating (Section 12)		89 (258)
SAP band		B

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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	9292.7162	0.2160	2007.2267 (261)
Space heating - secondary	1434.4141	0.0190	27.2539 (263)
Water heating (other fuel)	1222.5899	0.2160	264.0794 (264)
Space and water heating			2298.5600 (265)
Pumps and fans	1195.5169	0.5190	620.4733 (267)
Energy for lighting	659.5133	0.5190	342.2874 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			2364.8834 (272)
CO2 emissions per m2			9.3500 (273)
EI value			89.3620
EI rating			89 (274)
EI band			B

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# 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	129.0900 (1b)	2.5000 (2b)	322.7250 (1b) - (3b)
First floor	123.8000 (1c)	3.1000 (2c)	383.7800 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	252.8900		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 706.5050 (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				0 * 10 =	0.0000 (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) =				0.0000 / (5) =	0.0000 (8)							
Pressure test					Yes							
Measured/design AP50					6.0000							
Infiltration rate					0.3000 (18)							
Number of sides sheltered					2 (19)							
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.8500 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2550 (21)							
Wind speed	Jan 7.0000	Feb 6.6000	Mar 6.3000	Apr 5.5000	May 5.5000	Jun 5.0000	Jul 4.9000	Aug 4.9000	Sep 5.4000	Oct 6.3000	Nov 6.6000	Dec 7.0000 (22)
Wind factor	1.7500	1.6500	1.5750	1.3750	1.3750	1.2500	1.2250	1.2250	1.3500	1.5750	1.6500	1.7500 (22a)
Adj infilt rate	0.4463	0.4208	0.4016	0.3506	0.3506	0.3188	0.3124	0.3124	0.3443	0.4016	0.4208	0.4463 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												79.0500 (23c)
Effective ac	0.5510	0.5255	0.5064	0.4554	0.4554	0.4235	0.4171	0.4171	0.4490	0.5064	0.5255	0.5510 (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					
New Glazing (Uw = 1.40)			59.9700	1.3258	79.5057		(27)					
Solid Doors			2.1500	1.1000	2.3650		(26)					
Half Glazed Door			3.8000	1.5000	5.7000		(26a)					
rooflights (Uw = 1.40)			1.8400	1.3258	2.4394		(27a)					
Ground Floor - 150mm pIR			129.0900	0.1100	14.1999	117.0000	15103.5300 (28a)					
External Wall	244.1800	65.9200	178.2600	0.1800	32.0868	9.0000	1604.3400 (29a)					
Insulated Sloping Rafter	127.3200	1.8400	125.4800	0.1600	20.0768	9.0000	1129.3200 (30)					
Insulated Ceiling - 450mm	25.6500		25.6500	0.0900	2.3085	10.5000	269.3250 (30)					
Flat Roof Bay/Entrance	3.9900		3.9900	0.1800	0.7182	9.0000	35.9100 (30)					
Total net area of external elements Aum(A, m2)			530.2300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	159.4003		(33)					
GF x 2.5 FF x 2.85			415.9100			9.0000	3743.1900 (32c)					
FF Floor			123.8000			18.0000	2228.4000 (32d)					
GF Ceiling			129.0900			18.0000	2323.6200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	26437.6350 (34)					
Thermal mass parameter (TMP) = Cm / TFA in kJ/m2K							104.5420 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.5213 (36)					
Total fabric heat loss						(33) + (36) =	180.9216 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 128.4638	Feb 122.5186	Mar 118.0596	Apr 106.1692	May 106.1692	Jun 98.7376	Jul 97.2513	Aug 97.2513	Sep 104.6828	Oct 118.0596	Nov 122.5186	Dec 128.4638 (38)
Heat transfer coeff	309.3854	303.4401	298.9812	287.0907	287.0907	279.6592	278.1729	278.1729	285.6044	298.9812	303.4401	309.3854 (39)
Average = Sum(39)m / 12 =												293.2837 (39)
HLP	Jan 1.2234	Feb 1.1999	Mar 1.1823	Apr 1.1352	May 1.1352	Jun 1.1059	Jul 1.1000	Aug 1.1000	Sep 1.1294	Oct 1.1823	Nov 1.1999	Dec 1.2234 (40)
HLP (average)												1.1597 (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	3.0707 (42)
Average daily hot water use (litres/day)	107.1288 (43)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	117.8417	113.5565	109.2714	104.9862	100.7011	96.4159	96.4159	100.7011	104.9862	109.2714	113.5565	117.8417	(44)	
Energy conte	174.7558	152.8426	157.7198	137.5040	131.9383	113.8528	105.5013	121.0643	122.5102	142.7738	155.8488	169.2417	(45)	
Energy content (annual)	Total = Sum(45)m =												1685.5534	(45)
Distribution loss (46)m = 0.15 x (45)m	26.2134	22.9264	23.6580	20.6256	19.7908	17.0779	15.8252	18.1596	18.3765	21.4161	23.3773	25.3863	(46)	
Water storage loss:														
Store volume													300.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.8900	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													1.0206	(55)
Total storage loss	31.6386	28.5768	31.6386	30.6180	31.6386	30.6180	31.6386	31.6386	30.6180	31.6386	30.6180	31.6386	(56)	
If cylinder contains dedicated solar storage	15.8193	14.2884	15.8193	15.3090	15.8193	15.3090	15.8193	15.8193	15.3090	15.8193	15.3090	15.8193	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	213.8375	188.1422	195.4058	168.5714	158.2257	139.0670	131.5561	148.0496	154.9283	180.4598	193.6698	208.3234	(62)	
Aperture area of solar collector													3.7600	(H1)
Zero-loss collector efficiency													0.7500	(H2)
Collector effective heat loss coefficient													6.0000	(H3b)
Collector performance ratio													8.0000	(H4)
Annual solar radiation per m2													1176.5711	(H5)
Overshading factor													0.8000	(H6)
Solar energy available													2654.3443	(H7)
Adjustment factor for showers													1.2900	(H7a)
Solar-to-load ratio													1.2207	(H8)
Utilisation factor													0.5592	(H9)
Collector performance factor													0.7148	(H10)
Dedicated solar storage volume													150.0000	(H11)
Effective solar volume													195.0000	(H13)
Daily hot water demand													107.1288	(H14)
Volume ratio Veff/V													1.8202	(H15)
Solar storage volume factor													1.0000	(H16)
Solar input													-1060.9908	(H17)
Solar input	-33.2146	-48.8843	-85.2766	-119.6926	-141.8166	-149.3827	-131.1346	-123.6197	-97.1829	-64.0855	-38.2699	-28.4308	(63)	
Solar input (sum of months) = Sum(63)m =													-1060.9908	(63)
Output from w/h	180.6229	139.2579	110.1292	48.8788	16.4091	0.0000	0.4215	24.4299	57.7454	116.3742	155.3999	179.8926	(64)	
Total per year (kWh/year) = Sum(64)m =													1029.5614	(64)
Heat gains from water heating, kWh/month	89.3717	79.0598	82.5906	70.5740	64.8994	58.0275	55.9230	61.8421	66.6691	77.6211	82.0765	87.5382	(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	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	184.2412	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	93.3609	82.9224	67.4370	51.0541	38.1636	32.2193	34.8141	45.2527	60.7380	77.1209	90.0115	95.9557	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	625.2094	631.6971	615.3483	580.5435	536.6088	495.3163	467.7304	461.2427	477.5916	512.3963	556.3310	597.6235	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	56.4948	(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)	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	-122.8275	(71)
Water heating gains (Table 5)	120.1232	117.6486	111.0089	98.0194	87.2304	80.5937	75.1653	83.1211	92.5960	104.3294	113.9952	117.6589	(72)
Total internal gains	959.6021	953.1766	914.7027	850.5257	782.9113	729.0379	698.6184	710.5250	751.8342	814.7551	881.2462	932.1467	(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 Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	5.4100	15.4538	0.6300	0.6300	0.7000	0.7700	25.5508	(75)					
Southeast	14.4400	47.2368	0.6300	0.6300	0.7000	0.7700	208.4585	(77)					
Southwest	11.1000	47.2368	0.6300	0.6300	0.7000	0.7700	160.2416	(79)					
Northwest	29.0200	15.4538	0.6300	0.6300	0.7000	0.7700	137.0581	(81)					
Southeast	0.9200	51.9931	0.6300	0.6300	0.7000	1.0000	18.9852	(82)					
Northwest	0.9200	23.2399	0.6300	0.6300	0.7000	1.0000	8.4860	(82)					
Solar gains	558.7802	870.1930	1319.1482	1902.8932	2215.9138	2437.8694	2060.9692	1911.7331	1543.5213	1011.8756	655.7823	485.6181	(83)
Total gains	1518.3823	1823.3696	2233.8508	2753.4188	2998.8251	3166.9073	2759.5876	2622.2581	2295.3554	1826.6307	1537.0285	1417.7648	(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	23.7367	24.2018	24.5627	25.5800	25.5800	26.2598	26.4001	26.4001	25.7131	24.5627	24.2018	23.7367		
alpha	2.5824	2.6135	2.6375	2.7053	2.7053	2.7507	2.7600	2.7600	2.7142	2.6375	2.6135	2.5824		
util living area	0.9563	0.9343	0.8845	0.7840	0.6694	0.5072	0.4321	0.4345	0.6106	0.8316	0.9283	0.9599	(86)	
MIT	19.4314	19.6067	19.9386	20.3530	20.6168	20.8063	20.8570	20.8584	20.7538	20.3768	19.8819	19.4478	(87)	
Th 2	19.9013	19.9201	19.9342	19.9722	19.9722	19.9961	20.0009	20.0009	19.9769	19.9342	19.9201	19.9013	(88)	

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

util rest of house	0.9481	0.9228	0.8651	0.7512	0.6206	0.4419	0.3486	0.3466	0.5339	0.7919	0.9125	0.9520 (89)
MIT 2	17.8454	18.1073	18.5853	19.1801	19.5240	19.7690	19.8278	19.8299	19.7048	19.2052	18.5079	17.8704 (90)
Living area fraction									fLA = Living area / (4) =			0.2899 (91)
MIT	18.3052	18.5420	18.9776	19.5201	19.8408	20.0697	20.1261	20.1280	20.0089	19.5448	18.9062	18.3277 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3052	18.5420	18.9776	19.5201	19.8408	20.0697	20.1261	20.1280	20.0089	19.5448	18.9062	18.3277 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9321	0.9038	0.8439	0.7350	0.6139	0.4469	0.3595	0.3583	0.5365	0.7745	0.8933	0.9368 (94)
Useful gains	1415.3469	1648.0489	1885.1844	2023.7386	1840.8347	1415.3524	992.0120	939.6082	1231.5315	1414.7403	1373.0246	1328.1122 (95)
Ext temp.	6.9000	7.0000	8.1000	9.8000	12.1000	14.6000	16.4000	16.6000	15.1000	12.5000	9.7000	7.3000 (96)
Heat loss rate W												
3528.5873	3502.2965	3252.2056	2790.5581	2222.3153	1529.6567	1036.5121	981.4024	1402.0044	2106.2749	2793.5358	3411.7941 (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												
1572.2508	1246.0544	1017.0637	552.1100	283.8216	0.0000	0.0000	0.0000	0.0000	514.5017	1022.7681	1550.2594 (98)	
Space heating												7758.8297 (98)
Space heating per m2												(98) / (4) = 30.6807 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.3000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												7733.0529 (211)
Space heating requirement	1572.2508	1246.0544	1017.0637	552.1100	283.8216	0.0000	0.0000	0.0000	0.0000	514.5017	1022.7681	1550.2594 (98)
Space heating efficiency (main heating system 1)	90.3000	90.3000	90.3000	90.3000	90.3000	0.0000	0.0000	0.0000	0.0000	90.3000	90.3000	90.3000 (210)
Space heating fuel (main heating system)	1567.0274	1241.9146	1013.6848	550.2758	282.8786	0.0000	0.0000	0.0000	0.0000	512.7924	1019.3702	1545.1090 (211)
Water heating requirement	241.8847	191.7007	156.4713	84.9400	43.6649	0.0000	0.0000	0.0000	0.0000	79.1541	157.3489	238.5014 (215)
Water heating requirement	180.6229	139.2579	110.1292	48.8788	16.4091	0.0000	0.4215	24.4299	57.7454	116.3742	155.3999	179.8926 (64)
Efficiency of water heater (217)m	88.9466	88.9788	89.0150	89.2258	89.5732	79.6000	79.6000	79.6000	79.6000	87.9262	88.5802	88.9347 (217)
Fuel for water heating, kWh/month	203.0690	156.5068	123.7198	54.7809	18.3192	0.0000	0.5295	30.6908	72.5445	132.3545	175.4342	202.2751 (219)
Water heating fuel used												1170.2243 (219)
Annual totals kWh/year												
Space heating fuel - main system												7733.0529 (211)
Space heating fuel - secondary												1193.6661 (215)
Electricity for pumps and fans: (BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.3000)												
mechanical ventilation fans (SFP = 1.3000)												1120.5169 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												1195.5169 (231)
Electricity for lighting (calculated in Appendix L)												659.5133 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1229 * 0.80) =									-1966.2029			-1966.2029 (233)
Total delivered energy for all uses												9985.7706 (238)

#### 10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7733.0529	3.7400	289.2162 (240)
Space heating - secondary	1193.6661	5.5200	65.8904 (242)
Water heating (other fuel)	1170.2243	3.7400	43.7664 (247)
Mechanical ventilation fans	1120.5169	20.4300	228.9216 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	659.5133	20.4300	134.7386 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1966.2029	20.4300	-401.6953 (252)
Total energy cost			471.1604 (255)

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

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: New Build (As Designed)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	7733.0529	0.2160	1670.3394 (261)
Space heating - secondary	1193.6661	0.0190	22.6797 (263)
Water heating (other fuel)	1170.2243	0.2160	252.7685 (264)
Space and water heating			1945.7875 (265)
Pumps and fans	1195.5169	0.5190	620.4733 (267)
Energy for lighting	659.5133	0.5190	342.2874 (268)
Energy saving/generation technologies			
PV Unit	-1966.2029	0.5190	-1020.4593 (269)
Total kg/year			1888.0889 (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	7733.0529	1.2200	9434.3245 (261)
Space heating - secondary	1193.6661	1.0400	1241.4128 (263)
Water heating (other fuel)	1170.2243	1.2200	1427.6737 (264)
Space and water heating			12103.4109 (265)
Pumps and fans	1195.5169	3.0700	3670.2370 (267)
Energy for lighting	659.5133	3.0700	2024.7059 (268)
Energy saving/generation technologies			
PV Unit	-1966.2029	3.0700	-6036.2430 (269)
Primary energy kWh/year			11762.1108 (272)
Primary energy kWh/m2/year			46.5108 (273)

# THERMAL BRIDGING

## Calculation Type: New Build (As Designed)

Property Reference	SAP04876 - Plot 01		Issued on Date	12/10/2022	
Assessment Reference	As Designed	Prop Type Ref	New Dwelling		
Property	Plot 1, Carnfloss, St Merryn, Nr Padstow, Cornwall, PL28 8NF				
SAP Rating	84 B	DER	13.72	TER	15.17
Environmental	85 B	% DER<TER	9.55		
CO <sub>2</sub> Emissions (t/year)	2.91	DFEE	51.45	TFEE	61.95
General Requirements Compliance	Pass	% DFEE<TFEE	16.94		
Assessor Details	Ms. Kim Oliver, Energy Services (Midlands) Ltd, Tel: 0121 5528425, kim@energyservice.co.uk			Assessor ID	L757-0001
Client	Sutton & Wilkinson Architects, Sutton & Wilkinson Architects				

	Junction detail	Source Type	Psi (W/mK)	Length (m)	Result	Reference
External wall	E2 Other lintels (including other steel lintels)	Independently assessed	0.030	38.39	1.15	Frame Homes EJ2
External wall	E3 Sill	Independently assessed	0.020	35.55	0.71	Frame Homes EJ1
External wall	E4 Jamb	Independently assessed	0.030	82.30	2.47	Frame Homes EJ3
External wall	E5 Ground floor (normal)	Independently assessed	0.060	48.85	2.93	Frame Homes GF1
External wall	E6 Intermediate floor within a dwelling	Independently assessed	0.090	47.30	4.26	Frame Homes WF1 & WF2
External wall	E11 Eaves (insulation at rafter level)	Independently assessed	0.040	18.99	0.76	Frame Homes WR3
External wall	E12 Gable (insulation at ceiling level)	Independently assessed	0.090	4.50	0.41	Frame Homes WR4
External wall	E13 Gable (insulation at rafter level)	Independently assessed	0.050	24.40	1.22	Frame Homes WR5
External wall	E14 Flat roof	Table K1 - Default	0.080	9.10	0.73	
External wall	E16 Corner (normal)	Independently assessed	0.090	42.70	3.84	Frame Homes PC5
External wall	E17 Corner (inverted – internal area greater than external area)	Independently assessed	0.000	17.30	0.00	Frame Homes PC4
External roof	R1 Head of roof window	Table K1 - Default	0.080	1.56	0.12	
External roof	R2 Sill of roof window	Table K1 - Default	0.060	1.56	0.09	
External roof	R3 Jamb of roof window	Table K1 - Default	0.080	4.72	0.38	
External roof	R4 Ridge (vaulted ceiling)	Table K1 - Default	0.080	8.20	0.66	
External roof	R5 Ridge (inverted)	Table K1 - Default	0.040	13.20	0.53	
External roof	R8 Roof to wall (rafter)	Table K1 - Default	0.060	21.10	1.27	

Total: **21.52** W/mK:  
 Y-Value: **0.041** W/m<sup>2</sup>K:



# PREDICTED ENERGY ASSESSMENT

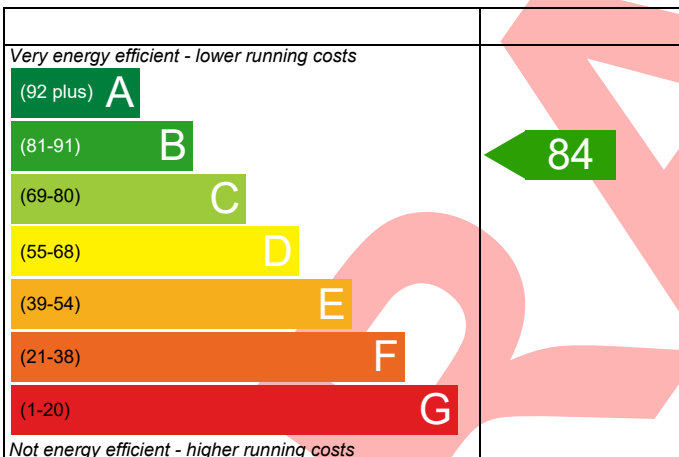
Plot 1, Carnfloss,  
St Merryn,  
Nr Padstow,  
Cornwall,  
PL28 8NF

Dwelling type: House, Detached  
Date of assessment: 12/10/2022  
Produced by: Energy Services (Midlands) Ltd  
Total floor area: 252.89 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.

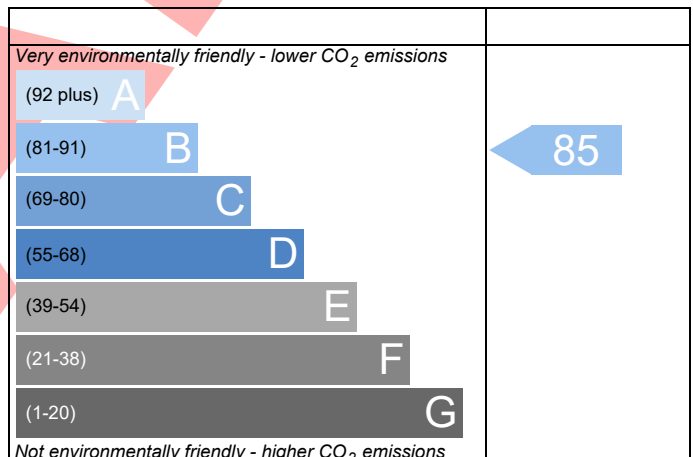
## Energy Efficiency Rating



**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.