



SAP Report Submission for Building Regulations Compliance

Client:

Project: Plot 2, 142-144, Whitley Wood Road
Reading, Berkshire, RG2 8PP

Contact: Scott Spearing
Scott Spearing
scott@beatsolutions.co.uk

Report Issue Date: 01/05/2025

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	BS-2209 - Plot 2			Issued on Date	01/05/2025
Assessment Reference	Rev -	Prop Type Ref			
Property	Plot 2, 142-144, Whitley Wood Road, Reading, Berkshire, RG2 8PP				
SAP Rating	89 B	DER	14.82	TER	23.77
Environmental	90 B	% DER<TER	37.66		
CO ₂ Emissions (t/year)	0.74	DFEE	35.97	TFEE	42.83
General Requirements Compliance	Pass	% DFEE<TFEE	16.02		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client					

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Electricity		
Fuel factor	1.55 (electricity)		
Target Carbon Dioxide Emission Rate (TER)	23.77	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.82	kgCO ₂ /m ²	Pass
	-8.95 (-37.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	42.83	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	35.97	kWh/m ² /yr	
	-6.8 (-15.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.17 (max. 2.00)	1.20 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system 1	Room heaters - Electric Panel, convector or radiant heaters	
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Main heating system 2

Heat pump with warm air distribution - Electric
Dimplex EDL200UK-630

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls 1

Programmer and appliance thermostats

Pass

Hot water controls

No cylinder

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

0.56

Maximum

1.5

Pass

MVHR efficiency

78 %

Minimum

70 %

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Thames Valley)

Slight

Pass

Based on:

Overshading

Average

Windows facing South East

11.62 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.01 (design value)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.11

W/m²K

Door U-value

1.00

W/m²K

Photovoltaic array

1.00

kW

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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, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2025
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:	13.20 m	40.66 m ²	2.40 m
	1st Storey:	13.20 m	40.66 m ²	2.10 m

7.0 Living Area	37.57	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	120.86	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.16	60.00	32.33	18.65
Rear Wall	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure	0.27	9.00	15.83	15.83

9.1 Party Walls					
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall	Filled Cavity with Edge Sealing	Double plasterboard on both sides, twin timber frame with/without sheathing board	0.00	20.00	55.52

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - Ground Floor	Plasterboard on timber frame		9.00	49.10
Internal Wall - First	Plasterboard on timber frame		9.00	71.06

10.0 External Roofs

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Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Sloping Roof	External Slope Roof	Plasterboard, insulated slope	0.10	9.00	20.93	20.93
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	27.78	27.78

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	40.66

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.11	110.00	40.66

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	40.66

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.00
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.20

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] External Walls	South East							2.06	
Front Elevation	Window	[1] External Walls	South East	None	0.00					11.62	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	6.61	0.049	Yes	UI-CWP-E2-WD-03 V2
Independently assessed	E3 Sill	5.63	0.025	Yes	UI-CWP-E3-WD-04 V1
Independently assessed	E4 Jamb	29.00	0.028	Yes	UI-CWP-E4-WD-05 V1
Independently assessed	E5 Ground floor (normal)	6.60	0.058	No	UI-CWP-E5-GF-01 V1
Independently assessed	E5 Ground floor (normal)	6.60	0.160	No	Back Wall - TBC BESPOKE CALC
Independently assessed	E6 Intermediate floor within a dwelling	6.60	0.001	No	UI-CWP-E6-IF-02 V1
Independently assessed	E14 Flat roof	6.60	0.080	No	TBC BESPOKE CALC
Table K1 - Default	E15 Flat roof with parapet	6.60	0.560	No	Back Wall
Independently assessed	E18 Party wall between dwellings	4.80	0.060	No	Back - TBC BESPOKE CALC
Table K1 - Approved	E18 Party wall between dwellings	9.80	0.060	No	Front
Independently assessed	P1 Party wall - Ground floor	12.33	0.160	No	TBC BESPOKE CALC
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	12.33	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	8.42	0.240	No	TBC BESPOKE CALC
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	6.35	0.240	No	TBC BESPOKE CALC
Table K1 - Default	R6 Flat ceiling	6.60	0.060	No	

Y-value	0.100	W/m²K
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18.0 Pressure Testing

Yes

Designed AP ₅₀	5.01	m³/(h.m²) @ 50 Pa
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Property Tested ?
As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

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

Mechanical Ventilation

Mechanical Ventilation System Present
Approved Installation
Mechanical Ventilation data Type
Type
MV Reference Number
Configuration
MVHR Duct Insulated
Manufacturer SFP
Duct Type
MVHR Efficiency
Wet Rooms

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

22.0 Lighting

Internal

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

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

Description
Percentage of Heat %
Main Heating
SAP Code
Efficiency (SAP Table) %
Controls
Sap Code

25.0 Main Heating 2

SUMMARY FOR INPUT DATA

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Description	HP Cylinder	
Percentage of Heat	0	%
Database Ref. No.	190006	
Fuel Type	Electricity	
Main Heating	PEH	
SAP Code	524	
In Summer	0.0	
Controls	CWA No time or thermostatic control of room temperature	
Sap Code	0	

Community Heating	None	
28.0 Water Heating	HWP From main heating 1	
Water Heating	Main Heating 2	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	914	
Immersion Only Heating Hot Water	No	
29.0 Hot Water Cylinder	Internal Store	
Insulation Type	Measured Loss	
Cylinder Volume	201.00	L
Loss	1.610	kWh/day

32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.00	South East	Horizontal	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£48	B 90	

U-VALUE CALCULATOR REPORT

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Client	
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Building Elements

Roof Sloping Roof

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Celotex GA4000				
	Main construction	90	0.0220	4.0909	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Celotex XR4000				
	Main construction	150	0.0220	6.8182	92.17
	Main construction	150	0.1300	1.1538	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Rafter Void				
	Main construction	90	0.2653	0.3392	92.17
	Main construction	90	0.1300	0.6923	7.83
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 5	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 10.668 m ² K/W	Lower limit = 9.576 m ² K/W	Average = 10.122 m ² K/W
	Total correction = 0.0024 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 346 mm

U-value: 0.10 W/m² K

Kappa: n/a

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Building Elements

Roof Roof

Roof Type: Pitched Roof, insulated sloping ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Celotex GA4000				
	Main construction	90	0.0220	4.0909	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Celotex XR4000				
	Main construction	150	0.0220	6.8182	92.17
	Main construction	150	0.1300	1.1538	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Standard cavity				
	Main construction	90	0.5625	0.1600	92.17
	Main construction	90	0.1300	0.6923	7.83
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 5	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 10.492 m ² K/W	Lower limit = 9.393 m ² K/W	Average = 9.942 m ² K/W
	Total correction = 0.0025 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 346 mm

U-value: 0.10 W/m² K

Kappa: n/a

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Building Elements

Wall External Walls

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Brick, outer leaf				
	Main construction	102.5	0.7700	0.1331	82.81
	Main construction	102.5	0.9407	0.1090	17.19
Layer 2	Standard cavity				
	Main construction	50	0.1124	0.4449	100.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 3	Thin-R Plus XT/CWP T&G				
	Main construction	100	0.0210	4.7619	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	Thermalite Shield				
	Main construction	100	0.1500	0.6667	93.43
	Main construction	100	0.8803	0.1136	6.57
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	airspace/plaster dabs				
	Main construction	15	0.0882	0.1700	80.00
	Main construction	15	0.0882	0.1700	20.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 6	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 7	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 6.370 m ² K/W	Lower limit = 6.247 m ² K/W	Average = 6.309 m ² K/W
	Total correction = 0.0058 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

Unheated space: None

Total thickness: 383 mm

U-value: 0.16 W/m² K

Kappa: n/a

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Building Elements

Wall Rear Wall

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Sandstone				
	Main construction	280	2.3000	0.1217	100.00
Layer 2	Polythene,1000 gauge				
	Main construction	0.5	0.0000	0.0000	100.00
Layer 3	Battens				
	Main construction	25	0.1389	0.1800	90.50
	Main construction	25	0.1300	0.1923	9.50
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 4	Kingspan Kooltherm K118				
	Main construction	60	0.0190	3.1579	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 6	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 3.698 m ² K/W	Lower limit = 3.698 m ² K/W	Average = 3.698 m ² K/W
	Total correction = 0.0073 m ² K/W	U-value (unrounded) = 0.27 W/m ² K	

Unheated space: None

Total thickness: 381 mm

U-value: 0.27 W/m² K

Kappa: n/a

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Building Elements

Floor Ground Floor

Floor Type: Slab On Ground Floor

Area = 40.66 m², Perimeter = 13.20 m, Wall thickness = 300.00 mm, Soil: Unknown

Horizontal edge insulation: none

Vertical edge insulation: none

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Concrete, reinforced (1% steel)				
	Main construction	100	2.3000	0.0435	100.00
Layer 2	Thin-R Plus XT/HYF				
	Main construction	150	0.0210	7.1429	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance:	Upper limit = 7.252 m ² K/W	Lower limit = 7.252 m ² K/W	Average = 7.252 m ² K/W
	Total correction = 0.0097 m ² K/W	U-value (unrounded) = 0.11 W/m ² K	

Unheated space: None

Total thickness: 325 mm

U-value: 0.11 W/m² K

Kappa: n/a

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 ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6600 (1b)	x 2.4000 (2b)	= 97.5840 (1b) - (3b)
First floor	40.6600 (1c)	x 2.1000 (2c)	= 85.3860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.9700 (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)			
									Air changes per hour			
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =							0.0000 / (5) =	0.0000 (8)			
Pressure test								Yes				
Measured/design AP50								5.0100				
Infiltration rate								0.2505	(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) =	0.2129 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	3.9000	4.0000	3.7000	3.7000	3.3000	3.3000	3.2000	3.2000	3.5000	3.5000	3.8000 (22)
Adj infilt rate	1.0500	0.9750	1.0000	0.9250	0.9250	0.8250	0.8250	0.8000	0.8000	0.8750	0.8750	0.9500 (22a)
	0.2236	0.2076	0.2129	0.1970	0.1970	0.1757	0.1757	0.1703	0.1703	0.1863	0.1863	0.2023 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
												0.5000 (23a)
												66.3000 (23c)
Effective ac	0.3921	0.3761	0.3814	0.3655	0.3655	0.3442	0.3442	0.3388	0.3388	0.3548	0.3548	0.3708 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.0600	1.0000	2.0600		(26)
Windows (Uw = 1.20)			11.6200	1.1450	13.3053		(27)
Ground Floor			40.6600	0.1100	4.4726	110.0000	4472.6000 (28a)
External Walls	32.3300	13.6800	18.6500	0.1600	2.9840	60.0000	1119.0000 (29a)
Rear Wall	15.8300		15.8300	0.2700	4.2741	9.0000	142.4700 (29a)
Sloping Roof	20.9300		20.9300	0.1000	2.0930	9.0000	188.3700 (30)
Flat Roof	27.7800		27.7800	0.1000	2.7780	9.0000	250.0200 (30)
Total net area of external elements Aum(A, m ²)			137.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.9670		(33)
Party Wall			55.5200	0.0000	0.0000	20.0000	1110.4000 (32)
Internal Wall - Ground Floor			49.1000			9.0000	441.9000 (32c)
Internal Wall - First			71.0600			9.0000	639.5400 (32c)
Internal Floor			40.6600			18.0000	731.8800 (32d)
Internal Ceiling			40.6600			18.0000	731.8800 (32e)

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CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat capacity $C_m = \text{Sum}(A \times k)$ (28)...(30) + (32) + (32a)...(32e) = 9828.0600 (34)
Thermal mass parameter (TMP = C_m / TFA) in kJ/m²K 120.8566 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 13.7356 (36)
Total fabric heat loss (33) + (36) = 45.7027 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.6733	22.7091	23.0305	22.0662	22.0662	20.7806	20.7806	20.4592	20.4592	21.4234	21.4234	22.3877 (38)
Heat transfer coeff	69.3760	68.4118	68.7332	67.7689	67.7689	66.4833	66.4833	66.1619	66.1619	67.1261	67.1261	68.0903 (39)
Average = Sum(39)m / 12 =												67.4743 (39)
HLP	0.8531	0.8413	0.8452	0.8334	0.8334	0.8176	0.8176	0.8136	0.8136	0.8255	0.8255	0.8373 (40)
HLP (average)												0.8297 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4874 (42)
Average daily hot water use (litres/day)												93.2765 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.6041	98.8730	95.1420	91.4109	87.6799	83.9488	83.9488	87.6799	91.4109	95.1420	98.8730	102.6041 (44)
Energy content (annual)	152.1589	133.0792	137.3258	119.7239	114.8780	99.1310	91.8594	105.4100	106.6689	124.3124	135.6967	147.3578 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8238	19.9619	20.5989	17.9586	17.2317	14.8696	13.7789	15.8115	16.0003	18.6469	20.3545	22.1037 (46)
Water storage loss:												
Store volume												201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Total heat required for water heating calculated for each month	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092 (64)
RHI water heating demand												1784.9328 (64)
Heat gains from water heating, kWh/month	50.5928	44.2488	45.6608	39.8082	38.1969	32.9610	30.5432	35.0488	35.4674	41.3339	45.1191	48.9965 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.8890	46.9756	38.2031	28.9222	21.6197	18.2523	19.7222	25.6357	34.4081	43.6890	50.9915	54.3590 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6077	335.0488	326.3774	307.9172	284.6144	262.7131	248.0817	244.6407	253.3120	271.7723	295.0750	316.9763 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972 (71)
Water heating gains (Table 5)	68.0011	65.8465	61.3721	55.2892	51.3400	45.7792	41.0528	47.1086	49.2603	55.5563	62.6655	65.8555 (72)
Total internal gains	554.6585	550.0314	528.1132	494.2892	459.7347	428.9052	411.0173	419.5456	439.1411	473.1782	510.8926	539.3514 (73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	FF	Access	Gains						
	m ²	Table 6a	Specific data	Specific data	factor	W						
		W/m ²	or Table 6b	or Table 6c	Table 6d							
Southeast	11.6200	42.9509	0.6300	0.7000	0.7700	152.5283 (77)						
Solar gains	152.5283	226.9708	308.9550	391.0280	429.4914	452.4260	433.3965	403.0372	357.3368	269.3442	179.9382	131.3229 (83)
Total gains	707.1868	777.0022	837.0682	885.3172	889.2261	881.3312	844.4138	822.5828	796.4778	742.5223	690.8308	670.6742 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	39.3510	39.9057	39.7191	40.2842	40.2842	41.0632	41.0632	41.2627	41.2627	40.6700	40.6700	40.0940

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CALCULATION OF HEAT DEMAND 09 Jan 2014

alpha	3.6234	3.6604	3.6479	3.6856	3.6856	3.7375	3.7375	3.7508	3.7508	3.7113	3.7113	3.6729
util living area	0.9191	0.8881	0.8285	0.7224	0.5839	0.3919	0.2663	0.2798	0.4934	0.7287	0.8711	0.9278 (86)
MIT	20.0116	20.2012	20.4654	20.7415	20.9064	20.9849	20.9974	20.9969	20.9624	20.7760	20.3980	19.9909 (87)
Th 2	20.2075	20.2177	20.2143	20.2245	20.2245	20.2381	20.2381	20.2416	20.2416	20.2313	20.2313	20.2211 (88)
util rest of house	0.9082	0.8739	0.8073	0.6905	0.5394	0.3382	0.2072	0.2199	0.4391	0.6916	0.8525	0.9179 (89)
MIT 2	18.9086	19.1819	19.5457	19.9230	20.1287	20.2266	20.2369	20.2400	20.2088	19.9796	19.4728	18.8899 (90)
Living area fraction									fLA = Living area / (4) =			0.4620 (91)
MIT	19.4182	19.6528	19.9706	20.3012	20.4880	20.5769	20.5882	20.5897	20.5570	20.3475	19.9002	19.3986 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4182	19.6528	19.9706	20.3012	20.4880	20.5769	20.5882	20.5897	20.5570	20.3475	19.9002	19.3986 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8956	0.8624	0.8001	0.6938	0.5549	0.3623	0.2345	0.2475	0.4621	0.6975	0.8437	0.9057 (94)
Useful gains	633.3317	670.0626	669.7520	614.1917	493.4351	319.3085	197.9871	203.5891	368.0135	517.9301	582.8299	607.4086 (95)
Ext temp.	5.0000	5.5000	7.3000	9.8000	12.7000	15.7000	17.6000	17.5000	14.8000	11.4000	7.9000	5.0000 (96)
Heat loss rate W	1000.2774	968.2195	870.8911	711.6521	527.7839	324.2325	198.6684	204.4191	380.8925	600.6107	805.5301	980.4027 (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	273.0076	200.3614	149.6475	70.1715	25.5555	0.0000	0.0000	0.0000	0.0000	61.5144	160.3441	277.5076 (98)
Space heating												1218.1096 (98)
RHI space heating demand												1218 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6600 (1b)	x 2.4000 (2b)	= 97.5840 (1b) - (3b)
First floor	40.6600 (1c)	x 2.1000 (2c)	= 85.3860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.9700 (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					5.0100							
Infiltration rate					0.2505 (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) = 0.2129 (21)							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	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)
	0.2715	0.2662	0.2608	0.2342	0.2289	0.2023	0.2023	0.1970	0.2129	0.2289	0.2395	0.2502 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.4400	0.4347	0.4293	0.4027	0.3974	0.3708	0.3708	0.3655	0.3814	0.3974	0.4080	0.4187 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.0600	1.0000	2.0600		(26)					
Windows (Uw = 1.20)			11.6200	1.1450	13.3053		(27)					
Ground Floor			40.6600	0.1100	4.4726	110.0000	4472.6000 (28a)					
External Walls	32.3300	13.6800	18.6500	0.1600	2.9840	60.0000	1119.0000 (29a)					
Rear Wall	15.8300		15.8300	0.2700	4.2741	9.0000	142.4700 (29a)					
Sloping Roof	20.9300		20.9300	0.1000	2.0930	9.0000	188.3700 (30)					
Flat Roof	27.7800		27.7800	0.1000	2.7780	9.0000	250.0200 (30)					
Total net area of external elements Aum(A, m2)			137.5300				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.9670		(33)					
Party Wall			55.5200	0.0000	0.0000	20.0000	1110.4000 (32)					
Internal Wall - Ground Floor			49.1000			9.0000	441.9000 (32c)					
Internal Wall - First			71.0600			9.0000	639.5400 (32c)					
Internal Floor			40.6600			18.0000	731.8800 (32d)					
Internal Ceiling			40.6600			18.0000	731.8800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	9828.0600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							120.8566 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7356 (36)					
Total fabric heat loss						(33) + (36) =	45.7027 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 26.5660	Feb 26.2446	Mar 25.9232	Apr 24.3161	May 23.9947	Jun 22.3877	Jul 22.3877	Aug 22.0662	Sep 23.0305	Oct 23.9947	Nov 24.6375	Dec 25.2804 (38)
Heat transfer coeff	72.2687	71.9473	71.6259	70.0188	69.6974	68.0903	68.0903	67.7689	68.7332	69.6974	70.3402	70.9830 (39)
Average = Sum(39)m / 12 =												69.9385 (39)
HLP	Jan 0.8887	Feb 0.8847	Mar 0.8808	Apr 0.8610	May 0.8571	Jun 0.8373	Jul 0.8373	Aug 0.8334	Sep 0.8452	Oct 0.8571	Nov 0.8650	Dec 0.8729 (40)
HLP (average)												0.8600 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4874 (42)
Average daily hot water use (litres/day)	93.2765 (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	102.6041	98.8730	95.1420	91.4109	87.6799	83.9488	83.9488	87.6799	91.4109	95.1420	98.8730	102.6041	(44)
Energy conte	152.1589	133.0792	137.3258	119.7239	114.8780	99.1310	91.8594	105.4100	106.6689	124.3124	135.6967	147.3578	(45)
Energy content (annual)	Total = Sum (45)m =												1467.6018 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8238	19.9619	20.5989	17.9586	17.2317	14.8696	13.7789	15.8115	16.0003	18.6469	20.3545	22.1037	(46)
Water storage loss:													
Store volume													201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum (63)m =													0.0000 (63)
Output from w/h	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092	(64)
Total per year (kWh/year) = Sum (64)m =													1784.9328 (64)
Heat gains from water heating, kWh/month	50.5928	44.2488	45.6608	39.8082	38.1969	32.9610	30.5432	35.0488	35.4674	41.3339	45.1191	48.9965	(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	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.8890	46.9756	38.2031	28.9222	21.6197	18.2523	19.7222	25.6357	34.4081	43.6890	50.9915	54.3590	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6077	335.0488	326.3774	307.9172	284.6144	262.7131	248.0817	244.6407	253.3120	271.7723	295.0750	316.9763	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	(71)
Water heating gains (Table 5)	68.0011	65.8465	61.3721	55.2892	51.3400	45.7792	41.0528	47.1086	49.2603	55.5563	62.6655	65.8555	(72)
Total internal gains	554.6585	550.0314	528.1132	494.2892	459.7347	428.9052	411.0173	419.5456	439.1411	473.1782	510.8926	539.3514	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W	
-----				-----				-----					
Southeast				11.6200	36.7938	0.6300	0.7000				0.7700	130.6631 (77)	
-----				-----				-----					
Solar gains	130.6631	222.5676	304.5267	377.3234	422.6336	419.5773	404.5173	370.7139	329.7380	245.9846	156.5043	111.8204	(83)
Total gains	685.3216	772.5990	832.6399	871.6125	882.3683	848.4826	815.5346	790.2594	768.8791	719.1628	667.3969	651.1717	(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	37.7759	37.9447	38.1150	38.9898	39.1696	40.0940	40.0940	40.2842	39.7191	39.1696	38.8116	38.4601	
alpha	3.5184	3.5296	3.5410	3.5993	3.6113	3.6729	3.6729	3.6856	3.6479	3.6113	3.5874	3.5640	
util living area	0.9360	0.9051	0.8569	0.7713	0.6503	0.4910	0.3614	0.3866	0.5715	0.7862	0.9024	0.9439	(86)
MIT	19.7997	20.0242	20.3080	20.6252	20.8403	20.9585	20.9896	20.9866	20.9249	20.6579	20.1966	19.7668	(87)
Th 2	20.1771	20.1805	20.1839	20.2008	20.2041	20.2211	20.2211	20.2245	20.2143	20.2041	20.1974	20.1906	(88)
util rest of house	0.9272	0.8927	0.8385	0.7433	0.6094	0.4375	0.2997	0.3243	0.5175	0.7542	0.8877	0.9361	(89)
MIT 2	18.5853	18.9050	19.3050	19.7506	20.0312	20.1845	20.2144	20.2154	20.1437	19.8051	19.1668	18.5480	(90)
Living area fraction	fLA = Living area / (4) =												0.4620 (91)
MIT	19.1464	19.4221	19.7684	20.1547	20.4050	20.5421	20.5725	20.5717	20.5046	20.1991	19.6426	19.1111	(92)
Temperature adjustment													0.0000
adjusted MIT	19.1464	19.4221	19.7684	20.1547	20.4050	20.5421	20.5725	20.5717	20.5046	20.1991	19.6426	19.1111	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	626.4077	679.5154	689.6073	646.3379	547.1120	390.2051	267.3324	278.5687	413.6113	542.2534	584.6894	601.3866	(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	1072.9274	1044.8238	950.3603	788.0399	606.7176	404.6010	270.4891	282.7109	440.2077	669.0337	882.2479	1058.4346	(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													

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Space heating	332.2107	245.4872	194.0002	102.0254	44.3466	0.0000	0.0000	0.0000	0.0000	94.3246	214.2421	340.0437 (98)
Space heating per m2												1566.6805 (98)
											(98) / (4) =	19.2656 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1566.6805 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	332.2107	245.4872	194.0002	102.0254	44.3466	0.0000	0.0000	0.0000	0.0000	94.3246	214.2421	340.0437 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	332.2107	245.4872	194.0002	102.0254	44.3466	0.0000	0.0000	0.0000	0.0000	94.3246	214.2421	340.0437 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)
Water heating												
Water heating requirement	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092 (64)
Efficiency of water heater	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (217)
Fuel for water heating, kWh/month	51.2608	45.0538	47.0156	41.7292	40.5911	35.8355	34.0033	37.8814	37.9929	43.2912	46.3005	49.8867 (219)
Water heating fuel used												510.8419 (219)
Annual totals kWh/year												
Space heating fuel - main system												1566.6805 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7000)												
mechanical ventilation fans (SFP = 0.7000)												156.2564 (230a)
Total electricity for the above, kWh/year												156.2564 (231)
Electricity for lighting (calculated in Appendix L)												373.6147 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.00 * 951 * 1.00) =										-760.4928		-760.4928 (233)
Total delivered energy for all uses												1846.9007 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1566.6805	13.1900	206.6452 (240)
Space heating - main system 2	0.0000	13.1900	0.0000 (241)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	510.8419	13.1900	67.3801 (247)
Mechanical ventilation fans	156.2564	13.1900	20.6102 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	373.6147	13.1900	49.2798 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-760.4928	13.1900	-100.3090 (252)
Total energy cost			243.6062 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8100 (257)
SAP value		88.7010
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1566.6805	0.5190	813.1072 (261)

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Space heating - main system 2	0.0000	0.5190	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	510.8419	0.5190	265.1270 (264)
Space and water heating			1078.2341 (265)
Pumps and fans	156.2564	0.5190	81.0971 (267)
Energy for lighting	373.6147	0.5190	193.9060 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-760.4928	0.5190	-394.6958 (269)
CO2 emissions per m2			958.5415 (272)
EI value			11.7900 (273)
EI rating			89.8318
EI band			90 (274) B

----- Calculation of stars for heating and DHW

Main heating 1 energy efficiency	$13.19 \times (1 + 0.29 \times 0.00) / 1.0000 = 13.190$, stars = 1
Main heating 2 energy efficiency	(does water heating only)
Main heating 1 environmental impact	$0.519 \times (1 + 0.29 \times 0.00) / 1.0000 = 0.5190$, stars = 2
Main heating 2 environmental impact	(does water heating only)
Water heating energy efficiency	$13.19 / 3.4941 = 3.775$, stars = 5
Water heating environmental impact	$0.519 / 3.4941 = 0.1485$, stars = 5

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6600 (1b)	x 2.4000 (2b)	= 97.5840 (1b) - (3b)
First floor	40.6600 (1c)	x 2.1000 (2c)	= 85.3860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.9700 (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					5.0100							
Infiltration rate					0.2505 (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) = 0.2129 (21)							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	3.9000	4.0000	3.7000	3.7000	3.3000	3.3000	3.2000	3.2000	3.5000	3.5000	3.8000 (22)
Adj infilt rate	1.0500	0.9750	1.0000	0.9250	0.9250	0.8250	0.8250	0.8000	0.8000	0.8750	0.8750	0.9500 (22a)
	0.2236	0.2076	0.2129	0.1970	0.1970	0.1757	0.1757	0.1703	0.1703	0.1863	0.1863	0.2023 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
												0.5000 (23a)
												66.3000 (23c)
Effective ac	0.3921	0.3761	0.3814	0.3655	0.3655	0.3442	0.3442	0.3388	0.3388	0.3548	0.3548	0.3708 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Front Door			2.0600	1.0000	2.0600			(26)					
Windows (Uw = 1.20)			11.6200	1.1450	13.3053			(27)					
Ground Floor			40.6600	0.1100	4.4726	110.0000	4472.6000	(28a)					
External Walls	32.3300	13.6800	18.6500	0.1600	2.9840	60.0000	1119.0000	(29a)					
Rear Wall	15.8300		15.8300	0.2700	4.2741	9.0000	142.4700	(29a)					
Sloping Roof	20.9300		20.9300	0.1000	2.0930	9.0000	188.3700	(30)					
Flat Roof	27.7800		27.7800	0.1000	2.7780	9.0000	250.0200	(30)					
Total net area of external elements Aum(A, m2)			137.5300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.9670			(33)					
Party Wall			55.5200	0.0000	0.0000	20.0000	1110.4000	(32)					
Internal Wall - Ground Floor			49.1000			9.0000	441.9000	(32c)					
Internal Wall - First			71.0600			9.0000	639.5400	(32c)					
Internal Floor			40.6600			18.0000	731.8800	(32d)					
Internal Ceiling			40.6600			18.0000	731.8800	(32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			9828.0600	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							120.8566	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7356	(36)					
Total fabric heat loss						(33) + (36) =	45.7027	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	23.6733	22.7091	23.0305	22.0662	22.0662	20.7806	20.7806	20.4592	20.4592	21.4234	21.4234	22.3877	(38)
Heat transfer coeff	69.3760	68.4118	68.7332	67.7689	67.7689	66.4833	66.4833	66.1619	66.1619	67.1261	67.1261	68.0903	(39)
Average = Sum(39)m / 12 =												67.4743	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8531	0.8413	0.8452	0.8334	0.8334	0.8176	0.8176	0.8136	0.8136	0.8255	0.8255	0.8373	(40)
HLP (average)												0.8297	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4874 (42)
Average daily hot water use (litres/day)	93.2765 (43)

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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	102.6041	98.8730	95.1420	91.4109	87.6799	83.9488	83.9488	87.6799	91.4109	95.1420	98.8730	102.6041	(44)
Energy conte	152.1589	133.0792	137.3258	119.7239	114.8780	99.1310	91.8594	105.4100	106.6689	124.3124	135.6967	147.3578	(45)
Energy content (annual)	Total = Sum (45)m =												1467.6018 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8238	19.9619	20.5989	17.9586	17.2317	14.8696	13.7789	15.8115	16.0003	18.6469	20.3545	22.1037	(46)
Water storage loss:													
Store volume													201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum (63)m =													0.0000 (63)
Output from w/h	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092	(64)
Total per year (kWh/year) = Sum (64)m =													1784.9328 (64)
Heat gains from water heating, kWh/month	50.5928	44.2488	45.6608	39.8082	38.1969	32.9610	30.5432	35.0488	35.4674	41.3339	45.1191	48.9965	(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	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.8890	46.9756	38.2031	28.9222	21.6197	18.2523	19.7222	25.6357	34.4081	43.6890	50.9915	54.3590	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6077	335.0488	326.3774	307.9172	284.6144	262.7131	248.0817	244.6407	253.3120	271.7723	295.0750	316.9763	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	(71)
Water heating gains (Table 5)	68.0011	65.8465	61.3721	55.2892	51.3400	45.7792	41.0528	47.1086	49.2603	55.5563	62.6655	65.8555	(72)
Total internal gains	554.6585	550.0314	528.1132	494.2892	459.7347	428.9052	411.0173	419.5456	439.1411	473.1782	510.8926	539.3514	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W

Southeast					11.6200	42.9509	0.6300	0.7000			0.7700			152.5283 (77)

Solar gains	152.5283	226.9708	308.9550	391.0280	429.4914	452.4260	433.3965	403.0372	357.3368	269.3442	179.9382	131.3229	(83)	
Total gains	707.1868	777.0022	837.0682	885.3172	889.2261	881.3312	844.4138	822.5828	796.4778	742.5223	690.8308	670.6742	(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	39.3510	39.9057	39.7191	40.2842	40.2842	41.0632	41.0632	41.2627	41.2627	40.6700	40.6700	40.0940	
alpha	3.6234	3.6604	3.6479	3.6856	3.6856	3.7375	3.7375	3.7508	3.7508	3.7113	3.7113	3.6729	
util living area	0.9191	0.8881	0.8285	0.7224	0.5839	0.3919	0.2663	0.2798	0.4934	0.7287	0.8711	0.9278	(86)
MIT	20.0116	20.2012	20.4654	20.7415	20.9064	20.9849	20.9974	20.9969	20.9624	20.7760	20.3980	19.9909	(87)
Th 2	20.2075	20.2177	20.2143	20.2245	20.2245	20.2381	20.2381	20.2416	20.2416	20.2313	20.2313	20.2211	(88)
util rest of house	0.9082	0.8739	0.8073	0.6905	0.5394	0.3382	0.2072	0.2199	0.4391	0.6916	0.8525	0.9179	(89)
MIT 2	18.9086	19.1819	19.5457	19.9230	20.1287	20.2266	20.2369	20.2400	20.2088	19.9796	19.4728	18.8899	(90)
Living area fraction	19.4182	19.6528	19.9706	20.3012	20.4880	20.5769	20.5882	20.5897	20.5570	20.3475	19.9002	19.3986	(92)
Temperature adjustment	19.4182	19.6528	19.9706	20.3012	20.4880	20.5769	20.5882	20.5897	20.5570	20.3475	19.9002	19.3986	(93)
adjusted MIT	19.4182	19.6528	19.9706	20.3012	20.4880	20.5769	20.5882	20.5897	20.5570	20.3475	19.9002	19.3986	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8956	0.8624	0.8001	0.6938	0.5549	0.3623	0.2345	0.2475	0.4621	0.6975	0.8437	0.9057	(94)
Useful gains	633.3317	670.0626	669.7520	614.1917	493.4351	319.3085	197.9871	203.5891	368.0135	517.9301	582.8299	607.4086	(95)
Ext temp.	5.0000	5.5000	7.3000	9.8000	12.7000	15.7000	17.6000	17.5000	14.8000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1000.2774	968.2195	870.8911	711.6521	527.7839	324.2325	198.6684	204.4191	380.8925	600.6107	805.5301	980.4027	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

273.0076	200.3614	149.6475	70.1715	25.5555	0.0000	0.0000	0.0000	0.0000	61.5144	160.3441	277.5076 (98)
Space heating											1218.1096 (98)
Space heating per m2											(98) / (4) = 14.9792 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Fraction of main heating from main system 2												0.0000 (203)
Fraction of total heating from main system 1												1.0000 (204)
Fraction of total heating from main system 2												0.0000 (205)
Efficiency of main space heating system 1 (in %)												100.0000 (206)
Efficiency of main space heating system 2 (in %)												0.0000 (207)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1218.1096 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	273.0076	200.3614	149.6475	70.1715	25.5555	0.0000	0.0000	0.0000	0.0000	61.5144	160.3441	277.5076 (98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000 (210)
Space heating fuel (main heating system)	273.0076	200.3614	149.6475	70.1715	25.5555	0.0000	0.0000	0.0000	0.0000	61.5144	160.3441	277.5076 (211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Space heating fuel used, main system 2												0.0000 (213)

Water heating												
Water heating requirement	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092 (64)
Efficiency of water heater	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (216)
(217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100 (217)
Fuel for water heating, kWh/month	51.2608	45.0538	47.0156	41.7292	40.5911	35.8355	34.0033	37.8814	37.9929	43.2912	46.3005	49.8867 (219)
Water heating fuel used												510.8419 (219)
Annual totals kWh/year												
Space heating fuel - main system												1218.1096 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:

(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7000)

mechanical ventilation fans (SFP = 0.7000)

Total electricity for the above, kWh/year

Electricity for lighting (calculated in Appendix L)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 1.00 * 1045 * 1.00) =

Total delivered energy for all uses

10a. Fuel costs - using BEDF prices (568)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	1218.1096	24.1800	294.5389 (240)
Space heating - main system 2	0.0000	24.1800	0.0000 (241)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	510.8419	24.1800	123.5216 (247)
Mechanical ventilation fans	156.2564	24.1800	37.7828 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	373.6147	24.1800	90.3400 (250)
Additional standing charges			0.0000 (251)

Energy saving/generation technologies			
PV Unit	-836.0256	24.1800	-202.1510 (252)
Total energy cost			344.0323 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	1218.1096	0.5190	632.1989 (261)
Space heating - main system 2	0.0000	0.5190	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	510.8419	0.5190	265.1270 (264)
Space and water heating			897.3259 (265)
Pumps and fans	156.2564	0.5190	81.0971 (267)
Energy for lighting	373.6147	0.5190	193.9060 (268)

Energy saving/generation technologies			
PV Unit	-836.0256	0.5190	-433.8973 (269)
Total kg/year			738.4317 (272)

FULL SAP CALCULATION PRINTOUT

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13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1218.1096	3.0700	3739.5965 (261)
Space heating - main system 2	0.0000	3.0700	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	510.8419	3.0700	1568.2848 (264)
Space and water heating			5307.8813 (265)
Pumps and fans	156.2564	3.0700	479.7071 (267)
Energy for lighting	373.6147	3.0700	1146.9972 (268)
Energy saving/generation technologies			
PV Unit	-836.0256	3.0700	-2566.5986 (269)
Primary energy kWh/year			4367.9870 (272)
Primary energy kWh/m2/year			53.7136 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 48	-103 kg (14.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£48 1.27 kg/m²	B 90	B 91
Total Savings	£48 1.27 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current £546	Potential £498	Saving £48
Electricity			
Space heating	£332	£332	£0
Water heating	£124	£75	£48
Lighting	£90	£90	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£344	£296	£48
Total cost of uses	£344	£295	£48
Delivered energy	17 kWh/m²	15 kWh/m²	2 kWh/m²
Carbon dioxide emissions	0.7 tonnes	0.6 tonnes	0.1 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	1 kg/m²
Primary energy	54 kWh/m²	46 kWh/m²	8 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6600 (1b)	x 2.4000 (2b)	= 97.5840 (1b) - (3b)
First floor	40.6600 (1c)	x 2.1000 (2c)	= 85.3860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 182.9700 (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					5.0100							
Infiltration rate					0.2505 (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) = 0.2129 (21)							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Adj infilt rate	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)
	0.2715	0.2662	0.2608	0.2342	0.2289	0.2023	0.2023	0.1970	0.2129	0.2289	0.2395	0.2502 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
												0.5000 (23a)
												66.3000 (23c)
Effective ac	0.4400	0.4347	0.4293	0.4027	0.3974	0.3708	0.3708	0.3655	0.3814	0.3974	0.4080	0.4187 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.0600	1.0000	2.0600		(26)
Windows (Uw = 1.20)			11.6200	1.1450	13.3053		(27)
Ground Floor			40.6600	0.1100	4.4726	110.0000	4472.6000 (28a)
External Walls	32.3300	13.6800	18.6500	0.1600	2.9840	60.0000	1119.0000 (29a)
Rear Wall	15.8300		15.8300	0.2700	4.2741	9.0000	142.4700 (29a)
Sloping Roof	20.9300		20.9300	0.1000	2.0930	9.0000	188.3700 (30)
Flat Roof	27.7800		27.7800	0.1000	2.7780	9.0000	250.0200 (30)
Total net area of external elements Aum(A, m ²)			137.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.9670		(32)
Party Wall			55.5200	0.0000	0.0000	20.0000	1110.4000 (32)
Internal Wall - Ground Floor			49.1000			9.0000	441.9000 (32c)
Internal Wall - First			71.0600			9.0000	639.5400 (32c)
Internal Floor			40.6600			18.0000	731.8800 (32d)
Internal Ceiling			40.6600			18.0000	731.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9828.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							120.8566 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7356 (36)
Total fabric heat loss						(33) + (36) =	45.7027 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	26.5660	26.2446	25.9232	24.3161	23.9947	22.3877	22.3877	22.0662	23.0305	23.9947	24.6375	25.2804 (38)
Heat transfer coeff	72.2687	71.9473	71.6259	70.0188	69.6974	68.0903	68.0903	67.7689	68.7332	69.6974	70.3402	70.9830 (39)
Average = Sum(39)m / 12 =												69.9385 (39)
HLP	Jan 0.8887	Feb 0.8847	Mar 0.8808	Apr 0.8610	May 0.8571	Jun 0.8373	Jul 0.8373	Aug 0.8334	Sep 0.8452	Oct 0.8571	Nov 0.8650	Dec 0.8729 (40)
HLP (average)												0.8600 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4874 (42)
Average daily hot water use (litres/day)	93.2765 (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	102.6041	98.8730	95.1420	91.4109	87.6799	83.9488	83.9488	87.6799	91.4109	95.1420	98.8730	102.6041	(44)
Energy conte	152.1589	133.0792	137.3258	119.7239	114.8780	99.1310	91.8594	105.4100	106.6689	124.3124	135.6967	147.3578	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	22.8238	19.9619	20.5989	17.9586	17.2317	14.8696	13.7789	15.8115	16.0003	18.6469	20.3545	22.1037	(46)
Water storage loss:													
Store volume													201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092	(62)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1079.5246 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1813.6014 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.2358 (H8)
Utilisation factor													0.5548 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													93.2765 (H14)
Volume ratio Veff/V													0.8041 (H15)
Solar storage volume factor													0.9564 (H16)
Solar input													-846.1362 (H17)
Solar input	-24.5363	-40.9440	-69.7323	-93.4550	-115.4558	-113.5114	-112.0113	-97.8648	-76.6478	-52.3414	-29.1035	-20.5327	(63)
Output from w/h	154.5741	116.4784	94.5449	52.3510	26.3736	11.7016	6.7995	34.4966	56.1031	98.9223	132.6751	153.7765	(64)
Heat gains from water heating, kWh/month	50.5928	44.2488	45.6608	39.8082	38.1969	32.9610	30.5432	35.0488	35.4674	41.3339	45.1191	48.9965	(65)
Total per year (kWh/year) = Sum(64)m =													938.7967 (64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.8890	46.9756	38.2031	28.9222	21.6197	18.2523	19.7222	25.6357	34.4081	43.6890	50.9915	54.3590	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6077	335.0488	326.3774	307.9172	284.6144	262.7131	248.0817	244.6407	253.3120	271.7723	295.0750	316.9763	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	(71)
Water heating gains (Table 5)	68.0011	65.8465	61.3721	55.2892	51.3400	45.7792	41.0528	47.1086	49.2603	55.5563	62.6655	65.8555	(72)
Total internal gains	554.6585	550.0314	528.1132	494.2892	459.7347	428.9052	411.0173	419.5456	439.1411	473.1782	510.8926	539.3514	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	

Southeast				11.6200		36.7938	0.6300		0.7000		0.7700		130.6631 (77)

Solar gains	130.6631	222.5676	304.5267	377.3234	422.6336	419.5773	404.5173	370.7139	329.7380	245.9846	156.5043	111.8204	(83)
Total gains	685.3216	772.5990	832.6399	871.6125	882.3683	848.4826	815.5346	790.2594	768.8791	719.1628	667.3969	651.1717	(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	37.7759	37.9447	38.1150	38.9898	39.1696	40.0940	40.0940	40.2842	39.7191	39.1696	38.8116	38.4601	
alpha	3.5184	3.5296	3.5410	3.5993	3.6113	3.6729	3.6729	3.6856	3.6479	3.6113	3.5874	3.5640	
util living area	0.9360	0.9051	0.8569	0.7713	0.6503	0.4910	0.3614	0.3866	0.5715	0.7862	0.9024	0.9439	(86)
MIT	19.7997	20.0242	20.3080	20.6252	20.8403	20.9585	20.9896	20.9866	20.9249	20.6579	20.1966	19.7668	(87)
Th 2	20.1771	20.1805	20.1839	20.2008	20.2041	20.2211	20.2211	20.2245	20.2143	20.2041	20.1974	20.1906	(88)
util rest of house	0.9272	0.8927	0.8385	0.7433	0.6094	0.4375	0.2997	0.3243	0.5175	0.7542	0.8877	0.9361	(89)
MIT 2	18.5853	18.9050	19.3050	19.7506	20.0312	20.1845	20.2144	20.2154	20.1437	19.8051	19.1668	18.5480	(90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =		0.4620 (91)
MIT	19.1464	19.4221	19.7684	20.1547	20.4050	20.5421	20.5725	20.5717	20.5046	20.1991	19.6426 (92)
Temperature adjustment											0.0000
adjusted MIT	19.1464	19.4221	19.7684	20.1547	20.4050	20.5421	20.5725	20.5717	20.5046	20.1991	19.6426 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9140	0.8795	0.8282	0.7415	0.6200	0.4599	0.3278	0.3525	0.5379	0.7540	0.8761	0.9235	(94)
Useful gains	626.4077	679.5154	689.6073	646.3379	547.1120	390.2051	267.3324	278.5687	413.6113	542.2534	584.6894	601.3866	(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													
Month fracti	1072.9274	1044.8238	950.3603	788.0399	606.7176	404.6010	270.4891	282.7109	440.2077	669.0337	882.2479	1058.4346	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	332.2107	245.4872	194.0002	102.0254	44.3466	0.0000	0.0000	0.0000	0.0000	94.3246	214.2421	340.0437	(98)
Space heating per m2												1566.6805	(98)
												(98) / (4) =	19.2656 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Fraction of main heating from main system 2													0.0000 (203)
Fraction of total heating from main system 1													1.0000 (204)
Fraction of total heating from main system 2													0.0000 (205)
Efficiency of main space heating system 1 (in %)													100.0000 (206)
Efficiency of main space heating system 2 (in %)													0.0000 (207)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1566.6805 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	332.2107	245.4872	194.0002	102.0254	44.3466	0.0000	0.0000	0.0000	0.0000	94.3246	214.2421	340.0437	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	332.2107	245.4872	194.0002	102.0254	44.3466	0.0000	0.0000	0.0000	0.0000	94.3246	214.2421	340.0437	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2													0.0000 (213)

Water heating													
Water heating requirement	154.5741	116.4784	94.5449	52.3510	26.3736	11.7016	6.7995	34.4966	56.1031	98.9223	132.6751	153.7765	(64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	44.2386	33.3357	27.0584	14.9827	7.5480	3.3489	1.9460	9.8728	16.0565	28.3112	37.9712	44.0103	(219)
Water heating fuel used													268.6805 (219)
Annual totals kWh/year													
Space heating fuel - main system													1566.6805 (211)
Space heating fuel - secondary													0.0000 (215)

Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7000)													
mechanical ventilation fans (SFP = 0.7000)													156.2564 (230a)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													206.2564 (231)
Electricity for lighting (calculated in Appendix L)													373.6147 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.00 * 951 * 1.00) =										-760.4928			-760.4928 (233)
Total delivered energy for all uses													1654.7393 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1566.6805	13.1900	206.6452	(240)
Space heating - main system 2	0.0000	13.1900	0.0000	(241)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	268.6805	13.1900	35.4390	(247)
Mechanical ventilation fans	156.2564	13.1900	20.6102	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	373.6147	13.1900	49.2798	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-760.4928	13.1900	-100.3090	(252)
Total energy cost			218.2601	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7257 (257)
SAP value		89.8766
SAP rating (Section 12)		90 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	1566.6805	0.5190	813.1072 (261)
Space heating - main system 2	0.0000	0.5190	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	268.6805	0.5190	139.4452 (264)
Space and water heating			952.5524 (265)
Pumps and fans	206.2564	0.5190	107.0471 (267)
Energy for lighting	373.6147	0.5190	193.9060 (268)
Energy saving/generation technologies			
PV Unit	-760.4928	0.5190	-394.6958 (269)
Total kg/year			858.8097 (272)
CO ₂ emissions per m ²			10.5600 (273)
EI value			90.8898
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.6600 (1b)	x 2.4000 (2b)	= 97.5840 (1b) - (3b)
First floor	40.6600 (1c)	x 2.1000 (2c)	= 85.3860 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	182.9700 (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					5.0100							
Infiltration rate					0.2505 (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) = 0.2129 (21)							
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.2000	3.9000	4.0000	3.7000	3.7000	3.3000	3.3000	3.2000	3.2000	3.5000	3.5000	3.8000 (22)
Adj infilt rate	1.0500	0.9750	1.0000	0.9250	0.9250	0.8250	0.8250	0.8000	0.8000	0.8750	0.8750	0.9500 (22a)
	0.2236	0.2076	0.2129	0.1970	0.1970	0.1757	0.1757	0.1703	0.1703	0.1863	0.1863	0.2023 (22b)
Balanced mechanical ventilation with heat recovery												
If mechanical ventilation:												
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =												
Effective ac	0.3921	0.3761	0.3814	0.3655	0.3655	0.3442	0.3442	0.3388	0.3388	0.3548	0.3548	0.3708 (25)
												0.5000 (23a)
												66.3000 (23c)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.0600	1.0000	2.0600		(26)
Windows (Uw = 1.20)			11.6200	1.1450	13.3053		(27)
Ground Floor			40.6600	0.1100	4.4726	110.0000	4472.6000 (28a)
External Walls	32.3300	13.6800	18.6500	0.1600	2.9840	60.0000	1119.0000 (29a)
Rear Wall	15.8300		15.8300	0.2700	4.2741	9.0000	142.4700 (29a)
Sloping Roof	20.9300		20.9300	0.1000	2.0930	9.0000	188.3700 (30)
Flat Roof	27.7800		27.7800	0.1000	2.7780	9.0000	250.0200 (30)
Total net area of external elements Aum(A, m ²)			137.5300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	31.9670		(32)
Party Wall			55.5200	0.0000	0.0000	20.0000	1110.4000 (32)
Internal Wall - Ground Floor			49.1000			9.0000	441.9000 (32c)
Internal Wall - First			71.0600			9.0000	639.5400 (32c)
Internal Floor			40.6600			18.0000	731.8800 (32d)
Internal Ceiling			40.6600			18.0000	731.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9828.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							120.8566 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.7356 (36)
Total fabric heat loss						(33) + (36) =	45.7027 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	23.6733	22.7091	23.0305	22.0662	22.0662	20.7806	20.7806	20.4592	20.4592	21.4234	21.4234	22.3877 (38)
Heat transfer coeff	69.3760	68.4118	68.7332	67.7689	67.7689	66.4833	66.4833	66.1619	66.1619	67.1261	67.1261	68.0903 (39)
Average = Sum(39)m / 12 =												67.4743 (39)
HLP	0.8531	0.8413	0.8452	0.8334	0.8334	0.8176	0.8176	0.8136	0.8136	0.8255	0.8255	0.8373 (40)
HLP (average)												0.8297 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4874 (42)
Average daily hot water use (litres/day)	93.2765 (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	102.6041	98.8730	95.1420	91.4109	87.6799	83.9488	83.9488	87.6799	91.4109	95.1420	98.8730	102.6041	(44)
Energy conte	152.1589	133.0792	137.3258	119.7239	114.8780	99.1310	91.8594	105.4100	106.6689	124.3124	135.6967	147.3578	(45)
Energy content (annual)													
Distribution loss (46)m = 0.15 x (45)m	22.8238	19.9619	20.5989	17.9586	17.2317	14.8696	13.7789	15.8115	16.0003	18.6469	20.3545	22.1037	(46)
Water storage loss:													
Store volume													201.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.6100 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Total heat required for water heating calculated for each month	179.1103	157.4224	164.2772	145.8059	141.8294	125.2130	118.8108	132.3614	132.7509	151.2638	161.7787	174.3092	(62)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1169.3274 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1964.4700 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.3386 (H8)
Utilisation factor													0.5262 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													93.2765 (H14)
Volume ratio Veff/V													0.8041 (H15)
Solar storage volume factor													0.9564 (H16)
Solar input													-869.3658 (H17)
Solar input	-27.7453	-40.5008	-68.5782	-93.4580	-112.6271	-117.1942	-115.0330	-102.4474	-80.4062	-55.6005	-32.4299	-23.3452	(63)
Output from w/h	151.3650	116.9216	95.6990	52.3479	29.2022	8.0188	3.7778	29.9141	52.3447	95.6632	129.3487	150.9640	(64)
Heat gains from water heating, kWh/month	50.5928	44.2488	45.6608	39.8082	38.1969	32.9610	30.5432	35.0488	35.4674	41.3339	45.1191	48.9965	(65)
Total per year (kWh/year) = Sum(64)m =													915.5670 (64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	149.2458	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.8890	46.9756	38.2031	28.9222	21.6197	18.2523	19.7222	25.6357	34.4081	43.6890	50.9915	54.3590	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.6077	335.0488	326.3774	307.9172	284.6144	262.7131	248.0817	244.6407	253.3120	271.7723	295.0750	316.9763	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	52.4120	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	-99.4972	(71)
Water heating gains (Table 5)	68.0011	65.8465	61.3721	55.2892	51.3400	45.7792	41.0528	47.1086	49.2603	55.5563	62.6655	65.8555	(72)
Total internal gains	554.6585	550.0314	528.1132	494.2892	459.7347	428.9052	411.0173	419.5456	439.1411	473.1782	510.8926	539.3514	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W	
-----								-----				
Southeast				11.6200	42.9509	0.6300	0.7000	0.7700			152.5283 (77)	
-----								-----				
Solar gains	152.5283	226.9708	308.9550	391.0280	429.4914	452.4260	433.3965	403.0372	357.3368	269.3442	179.9382	131.3229 (83)
Total gains	707.1868	777.0022	837.0682	885.3172	889.2261	881.3312	844.4138	822.5828	796.4778	742.5223	690.8308	670.6742 (84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	39.3510	39.9057	39.7191	40.2842	40.2842	41.0632	41.0632	41.2627	41.2627	40.6700	40.6700	40.0940	
alpha	3.6234	3.6604	3.6479	3.6856	3.6856	3.7375	3.7375	3.7508	3.7508	3.7113	3.7113	3.6729	
util living area	0.9191	0.8881	0.8285	0.7224	0.5839	0.3919	0.2663	0.2798	0.4934	0.7287	0.8711	0.9278	(86)
MIT	20.0116	20.2012	20.4654	20.7415	20.9064	20.9849	20.9974	20.9969	20.9624	20.7760	20.3980	19.9909	(87)
Th 2	20.2075	20.2177	20.2143	20.2245	20.2245	20.2381	20.2381	20.2416	20.2416	20.2313	20.2313	20.2211	(88)
util rest of house	0.9082	0.8739	0.8073	0.6905	0.5394	0.3382	0.2072	0.2199	0.4391	0.6916	0.8525	0.9179	(89)
MIT 2	18.9086	19.1819	19.5457	19.9230	20.1287	20.2266	20.2369	20.2400	20.2088	19.9796	19.4728	18.8899	(90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Living area fraction									fLA = Living area / (4) =			0.4620 (91)
MIT	19.4182	19.6528	19.9706	20.3012	20.4880	20.5769	20.5882	20.5897	20.5570	20.3475	19.9002	19.3986 (92)
Temperature adjustment												0.0000
adjusted MIT	19.4182	19.6528	19.9706	20.3012	20.4880	20.5769	20.5882	20.5897	20.5570	20.3475	19.9002	19.3986 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8956	0.8624	0.8001	0.6938	0.5549	0.3623	0.2345	0.2475	0.4621	0.6975	0.8437	0.9057	(94)
Useful gains	633.3317	670.0626	669.7520	614.1917	493.4351	319.3085	197.9871	203.5891	368.0135	517.9301	582.8299	607.4086	(95)
Ext temp.	5.0000	5.5000	7.3000	9.8000	12.7000	15.7000	17.6000	17.5000	14.8000	11.4000	7.9000	5.0000	(96)
Heat loss rate W													
Month fracti	1000.2774	968.2195	870.8911	711.6521	527.7839	324.2325	198.6684	204.4191	380.8925	600.6107	805.5301	980.4027	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	273.0076	200.3614	149.6475	70.1715	25.5555	0.0000	0.0000	0.0000	0.0000	61.5144	160.3441	277.5076	(98)
Space heating per m2												1218.1096	(98)
												(98) / (4) =	14.9792 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)		0.0000 (201)
Fraction of space heat from main system(s)		1.0000 (202)
Fraction of main heating from main system 2		0.0000 (203)
Fraction of total heating from main system 1		1.0000 (204)
Fraction of total heating from main system 2		0.0000 (205)
Efficiency of main space heating system 1 (in %)		100.0000 (206)
Efficiency of main space heating system 2 (in %)		0.0000 (207)
Efficiency of secondary/supplementary heating system, %		0.0000 (208)
Space heating requirement		1218.1096 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	273.0076	200.3614	149.6475	70.1715	25.5555	0.0000	0.0000	0.0000	0.0000	61.5144	160.3441	277.5076	(98)
Space heating efficiency (main heating system 1)	100.0000	100.0000	100.0000	100.0000	100.0000	0.0000	0.0000	0.0000	0.0000	100.0000	100.0000	100.0000	(210)
Space heating fuel (main heating system)	273.0076	200.3614	149.6475	70.1715	25.5555	0.0000	0.0000	0.0000	0.0000	61.5144	160.3441	277.5076	(211)
Space heating efficiency (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(212)
Space heating fuel (main heating system 2)	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(213)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Space heating fuel used, main system 2												0.0000	(213)

Water heating requirement	151.3650	116.9216	95.6990	52.3479	29.2022	8.0188	3.7778	29.9141	52.3447	95.6632	129.3487	150.9640	(64)
Efficiency of water heater (217)m	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	349.4100	(216)
Fuel for water heating, kWh/month	43.3202	33.4626	27.3887	14.9818	8.3576	2.2949	1.0812	8.5613	14.9809	27.3785	37.0192	43.2054	(219)
Water heating fuel used												262.0323	(219)
Annual totals kWh/year													
Space heating fuel - main system												1218.1096	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7000)		
mechanical ventilation fans (SFP = 0.7000)		156.2564 (230a)
pump for solar water heating		50.0000 (230g)
Total electricity for the above, kWh/year		206.2564 (231)
Electricity for lighting (calculated in Appendix L)		373.6147 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.00 * 1045 * 1.00) =	-836.0256	-836.0256 (233)
Total delivered energy for all uses		1223.9874 (238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1218.1096	24.1800	294.5389	(240)
Space heating - main system 2	0.0000	24.1800	0.0000	(241)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	262.0323	24.1800	63.3594	(247)
Mechanical ventilation fans	156.2564	24.1800	37.7828	(249)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	24.1800	12.0900	(249)
Energy for lighting	373.6147	24.1800	90.3400	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-836.0256	24.1800	-202.1510	(252)
Total energy cost			295.9602	(255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	1218.1096	0.5190	632.1989 (261)
Space heating - main system 2	0.0000	0.5190	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	262.0323	0.5190	135.9948 (264)
Space and water heating			768.1937 (265)
Pumps and fans	206.2564	0.5190	107.0471 (267)
Energy for lighting	373.6147	0.5190	193.9060 (268)
Energy saving/generation technologies			
PV Unit	-836.0256	0.5190	-433.8973 (269)
Total kg/year			635.2495 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	1218.1096	3.0700	3739.5965 (261)
Space heating - main system 2	0.0000	3.0700	0.0000 (262)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	262.0323	3.0700	804.4391 (264)
Space and water heating			4544.0357 (265)
Pumps and fans	206.2564	3.0700	633.2071 (267)
Energy for lighting	373.6147	3.0700	1146.9972 (268)
Energy saving/generation technologies			
PV Unit	-836.0256	3.0700	-2566.5986 (269)
Primary energy kWh/year			3757.6414 (272)
Primary energy kWh/m2/year			46.2081 (273)