



SAP Report Submission for Building Regulations Compliance

Client:

Project: Plot 3, 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 3		Issued on Date	01/05/2025	
Assessment Reference	Rev -		Prop Type Ref		
Property	Plot 3, 142-144, Whitley Wood Road, Reading, Berkshire, RG2 8PP				
SAP Rating	87 B	DER	16.32	TER	25.69
Environmental	89 B	% DER<TER	36.47		
CO₂ Emissions (t/year)	0.83	DFEE	38.60	TFEE	49.35
General Requirements Compliance	Pass	% DFEE<TFEE	21.79		
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)	25.69	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	16.32	kgCO ₂ /m ²	Pass
	-9.37 (-36.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	49.35	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	38.60	kWh/m ² /yr	
	-10.8 (-21.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.17 (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

0.12

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, End-Terrace						
2.0 Number of Storeys	2						
3.0 Date Built	2025						
4.0 Sheltered Sides	1						
5.0 Sunlight/Shade	Average or unknown						
6.0 Measurements							
		Heat Loss Perimeter		Internal Floor Area		Average Storey Height	
Ground Floor:		19.46 m		40.98 m ²		2.40 m	
1st Storey:		19.46 m		40.98 m ²		2.10 m	
7.0 Living Area	37.30			m ²			
8.0 Thermal Mass Parameter	Precise calculation						
Thermal Mass	134.34			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	45.56	31.88
Rear Wall	Solid Wall	Solid wall : plasterboard on dabs, insulation, any outside structure		0.27	9.00	15.96	15.96
External Walls to Commercial	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure		0.16	60.00	14.79	14.79
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 f rame with/without sheathing board		0.00	20.00	27.76	
9.2 Internal Walls							
Description	Construction				Kappa (kJ/m ² K)	Area (m ²)	
Internal Wall - Ground Floor	Plasterboard on timber frame				9.00	49.38	
Internal Wall - First	Plasterboard on timber frame				9.00	71.30	
10.0 External Roofs							

SUMMARY FOR INPUT DATA

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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	21.10	21.10
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.10	9.00	28.00	28.00

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	40.99

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	0.12	110.00	40.98

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	40.99

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacture	Solid Door							1.00
Windows	Manufacture	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

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

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)	12.81	0.058	No	UI-CWP-E5-GF-01 V1
Independently assessed	E5 Ground floor (normal)	6.65	0.160	No	Back Wall - TBC BESPOKE CALC
Independently assessed	E6 Intermediate floor within a dwelling	6.65	0.001	No	UI-CWP-E6-IF-02 V1
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	6.16	0.240	No	
Table K1 - Approved	E13 Gable (insulation at rafter level)	3.17	0.040	No	
Independently assessed	E14 Flat roof	10.86	0.080	No	TBC BESPOKE CALC
Table K1 - Default	E15 Flat roof with parapet	6.65	0.560	No	Back Wall
Independently assessed	E16 Corner (normal)	4.90	0.039	No	UI-CWP-E16-EXT-CRN V1
Table K1 - Approved	E16 Corner (normal)	2.40	0.090	No	External to Rear
Independently assessed	E18 Party wall between dwellings	2.40	0.060	No	Back - TBC BESPOKE CALC
Independently assessed	E18 Party wall between dwellings	4.90	0.060	No	Front - TBC BESPOKE CALC
Independently assessed	P1 Party wall - Ground floor	6.16	0.160	No	TBC BESPOKE CALC
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	6.16	0.000	No	
Independently assessed	P4 Party wall - Roof (insulation at ceiling level)	4.21	0.240	No	TBC BESPOKE CALC
Independently assessed	P5 Party wall - Roof (insulation at rafter level)	3.17	0.240	No	TBC BESPOKE CALC
Table K1 - Default	R6 Flat ceiling	6.65	0.060	No	

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Y-value	0.080	W/m²K
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18.0 Pressure Testing	Yes	
Designed AP ₅₀	5.01	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Balanced mechanical ventilation with heat recovery
MV Reference Number	500773
Configuration	1
MVHR Duct Insulated	Yes
Manufacturer SFP	0.56
Duct Type	Rigid
MVHR Efficiency	78.00
Wet Rooms	1

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

No

22.0 Lighting

Internal

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

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

SAP table		
Description	Panel Heaters	
Percentage of Heat	100	%
Main Heating	REA	
SAP Code	691	
Efficiency (SAP Table)	100.0	%

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Controls	CRC Programmer and appliance thermostats
Sap Code	2603

25.0 Main Heating 2	Database	%
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 89	

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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

Wall Wall to garage

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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Project	Plot 3, 142-144, Whitley Wood Road, Reading, Berkshire, RG2 8PP		
Calculation Type	New Build (As Designed)		

SAP Rating	87 B	DER	16.32	TER	25.69
Environmental	89 B	% DER<TER	36.47		
CO ₂ Emissions (t/year)	0.83	DFEE	38.60	TFEE	49.35
General Requirements Compliance	Pass	% DFEE<TFEE	21.79		

Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
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Client	
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Building Elements

Floor Ground Floor

Floor Type: Slab On Ground Floor

Area = 40.98 m², Perimeter = 19.46 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) = 0.12 W/m ² K	

Unheated space: None

Total thickness: 325 mm

U-value: 0.12 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	BS-2209 - Plot 3			Issued on Date	01/05/2025
Assessment Reference	Rev -	Prop Type Ref			
Property	Plot 3, 142-144, Whitley Wood Road, Reading, Berkshire, RG2 8PP				
SAP Rating	87 B	DER	16.32	TER	25.69
Environmental	89 B	% DER<TER	36.47		
CO ₂ Emissions (t/year)	0.83	DFEE	38.60	TFEE	49.35
General Requirements Compliance	Pass	% DFEE<TFEE	21.79		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client					

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	40.9800 (1b)	x 2.4000 (2b)	= 98.3520 (1b) - (3b)
First floor	40.9800 (1c)	x 2.1000 (2c)	= 86.0580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.4100 (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								1	(19)			
Shelter factor								(20) = 1 - [0.075 x (19)] =	0.9250 (20)			
Infiltration rate adjusted to include shelter factor								(21) = (18) x (20) =	0.2317 (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)
	0.2433	0.2259	0.2317	0.2143	0.2143	0.1912	0.1912	0.1854	0.1854	0.2027	0.2027	0.2201 (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	0.4118	0.3944	0.4002	0.3828	0.3828	0.3597	0.3597	0.3539	0.3539	0.3712	0.3712	0.3886 (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			40.9800	0.1200	4.9176	110.0000	4507.8000 (28a)
External Walls	45.5600	13.6800	31.8800	0.1600	5.1008	60.0000	1912.8000 (29a)
Rear Wall	15.9600		15.9600	0.2700	4.3092	9.0000	143.6400 (29a)
External Walls to Commercial	14.7900		14.7900	0.0800	1.1832	60.0000	887.4000 (29a)
Sloping Roof	21.1000		21.1000	0.1000	2.1100	9.0000	189.9000 (30)
Flat Roof	28.0000		28.0000	0.1000	2.8000	9.0000	252.0000 (30)
Total net area of external elements Aum(A, m ²)			166.3900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7861		(33)
Party Wall			27.7600	0.0000	0.0000	20.0000	555.2000 (32)
Internal Wall - Ground Floor			49.3800			9.0000	444.4200 (32c)
Internal Wall - First			71.3000			9.0000	641.7000 (32c)
Internal Floor			40.9900			18.0000	737.8200 (32d)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Internal Ceiling	40.9900						18.0000				737.8200 (32e)	
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) =				11010.5000 (34)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K											134.3399 (35)	
Thermal bridges (Sum(L x Psi) calculated using Appendix K)											13.2892 (36)	
Total fabric heat loss							(33) + (36) =				49.0753 (37)	
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	25.0601	24.0025	24.3551	23.2975	23.2975	21.8874	21.8874	21.5349	21.5349	22.5924	22.5924	23.6500 (38)
Average = Sum(39)m / 12 =	74.1354	73.0778	73.4304	72.3728	72.3728	70.9627	70.9627	70.6102	70.6102	71.6677	71.6677	72.7253 (39)
												72.0496 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.9045	0.8916	0.8959	0.8830	0.8830	0.8658	0.8658	0.8615	0.8615	0.8744	0.8744	0.8873 (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												2.4990 (42)
Average daily hot water use (litres/day)												93.5512 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.9063	99.1643	95.4222	91.6802	87.9381	84.1961	84.1961	87.9381	91.6802	95.4222	99.1643	102.9063 (44)
Energy content (annual)	152.6071	133.4712	137.7303	120.0766	115.2164	99.4230	92.1300	105.7205	106.9832	124.6785	136.0964	147.7919 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1471.9250 (45)
	22.8911	20.0207	20.6595	18.0115	17.2825	14.9134	13.8195	15.8581	16.0475	18.7018	20.4145	22.1688 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (64)
												Total per year (kWh/year) = Sum(64)m = 1789.2560 (64)
RHI water heating demand												1789 (64)
Heat gains from water heating, kWh/month	50.7419	44.3792	45.7953	39.9255	38.3094	33.0581	30.6332	35.1521	35.5719	41.4556	45.2520	49.1408 (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	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2913	47.3328	38.4937	29.1422	21.7841	18.3911	19.8722	25.8306	34.6698	44.0213	51.3794	54.7724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.5643	337.0256	328.3031	309.7340	286.2937	264.2632	249.5455	246.0841	254.8066	273.3758	296.8160	318.8465 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930 (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)	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600 (71)
Water heating gains (Table 5)	68.2014	66.0404	61.5529	55.4520	51.4912	45.9141	41.1737	47.2474	49.4054	55.7199	62.8501	66.0495 (72)
Total internal gains	557.5300	552.8719	530.8226	496.8012	462.0420	431.0413	413.0643	421.6351	441.3548	475.5900	513.5184	542.1414 (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	710.0583	779.8427	839.7776	887.8291	891.5334	883.4673	846.4608	824.6723	798.6916	744.9341	693.4566	673.4643	(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	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

tau	41.2552	41.8523	41.6513	42.2600	42.2600	43.0997	43.0997	43.3149	43.3149	42.6757	42.6757	42.0551
alpha	3.7503	3.7902	3.7768	3.8173	3.8173	3.8733	3.8733	3.8877	3.8877	3.8450	3.8450	3.8037
util living area	0.9358	0.9091	0.8555	0.7549	0.6165	0.4166	0.2835	0.2977	0.5229	0.7609	0.8941	0.9433 (86)
MIT	19.9860	20.1731	20.4395	20.7254	20.9002	20.9842	20.9974	20.9968	20.9603	20.7623	20.3744	19.9676 (87)
Th 2	20.1636	20.1746	20.1710	20.1820	20.1820	20.1966	20.1966	20.2003	20.2003	20.1893	20.1893	20.1783 (88)
util rest of house	0.9259	0.8958	0.8346	0.7218	0.5683	0.3567	0.2172	0.2306	0.4630	0.7224	0.8764	0.9344 (89)
MIT 2	18.8350	19.1062	19.4739	19.8651	20.0821	20.1852	20.1955	20.1989	20.1670	19.9257	19.4048	18.8200 (90)
Living area fraction									fLA = Living area / (4) =			0.4551 (91)
MIT	19.3588	19.5917	19.9134	20.2566	20.4544	20.5488	20.5604	20.5620	20.5280	20.3064	19.8461	19.3423 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3588	19.5917	19.9134	20.2566	20.4544	20.5488	20.5604	20.5620	20.5280	20.3064	19.8461	19.3423 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9146	0.8850	0.8275	0.7250	0.5848	0.3832	0.2473	0.2611	0.4880	0.7283	0.8679	0.9235 (94)
Useful gains	649.4150	690.1812	694.9290	643.6468	521.3957	338.5832	209.3650	215.3344	389.7555	542.5648	601.8662	621.9762 (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	1064.4977	1029.7933	926.2036	756.7756	561.2075	344.0858	210.0808	216.2117	404.4552	638.3034	856.1483	1043.0485 (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	308.8215	228.2193	172.0683	81.4527	29.6200	0.0000	0.0000	0.0000	0.0000	71.2295	183.0831	313.2778 (98)
Space heating												1387.7723 (98)
RHI space heating demand												1388 (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	40.9800 (1b)	x 2.4000 (2b)	= 98.3520 (1b) - (3b)
First floor	40.9800 (1c)	x 2.1000 (2c)	= 86.0580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.4100 (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											1	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2317 (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)
	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (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) =												66.3000 (23c)
Effective ac	0.4639	0.4581	0.4523	0.4234	0.4176	0.3886	0.3886	0.3828	0.4002	0.4176	0.4292	0.4408 (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			40.9800	0.1200	4.9176	110.0000	4507.8000	(28a)					
External Walls	45.5600	13.6800	31.8800	0.1600	5.1008	60.0000	1912.8000	(29a)					
Rear Wall	15.9600		15.9600	0.2700	4.3092	9.0000	143.6400	(29a)					
External Walls to Commercial	14.7900		14.7900	0.0800	1.1832	60.0000	887.4000	(29a)					
Sloping Roof	21.1000		21.1000	0.1000	2.1100	9.0000	189.9000	(30)					
Flat Roof	28.0000		28.0000	0.1000	2.8000	9.0000	252.0000	(30)					
Total net area of external elements Aum(A, m2)			166.3900					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7861			(33)					
Party Wall			27.7600	0.0000	0.0000	20.0000	555.2000	(32)					
Internal Wall - Ground Floor			49.3800			9.0000	444.4200	(32c)					
Internal Wall - First			71.3000			9.0000	641.7000	(32c)					
Internal Floor			40.9900			18.0000	737.8200	(32d)					
Internal Ceiling			40.9900			18.0000	737.8200	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11010.5000	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.3399	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2892	(36)					
Total fabric heat loss						(33) + (36) =	49.0753	(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	28.2328	27.8803	27.5278	25.7651	25.4126	23.6500	23.6500	23.2975	24.3551	25.4126	26.1177	26.8227	(38)
Heat transfer coeff	77.3081	76.9556	76.6031	74.8405	74.4879	72.7253	72.7253	72.3728	73.4304	74.4879	75.1930	75.8980	(39)
Average = Sum(39)m / 12 =												74.7523	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9432	0.9389	0.9346	0.9131	0.9088	0.8873	0.8873	0.8830	0.8959	0.9088	0.9174	0.9260	(40)
HLP (average)												0.9121	(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 2.4990 (42)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Average daily hot water use (litres/day)												93.5512 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.9063	99.1643	95.4222	91.6802	87.9381	84.1961	84.1961	87.9381	91.6802	95.4222	99.1643	102.9063 (44)
Energy content (annual)	152.6071	133.4712	137.7303	120.0766	115.2164	99.4230	92.1300	105.7205	106.9832	124.6785	136.0964	147.7919 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8911	20.0207	20.6595	18.0115	17.2825	14.9134	13.8195	15.8581	16.0475	18.7018	20.4145	22.1688 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (64)
Heat gains from water heating, kWh/month	50.7419	44.3792	45.7953	39.9255	38.3094	33.0581	30.6332	35.1521	35.5719	41.4556	45.2520	49.1408 (65)
Total per year (kWh/year) = Sum (64)m =												1789.2560 (64)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2913	47.3328	38.4937	29.1422	21.7841	18.3911	19.8722	25.8306	34.6698	44.0213	51.3794	54.7724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.5643	337.0256	328.3031	309.7340	286.2937	264.2632	249.5455	246.0841	254.8066	273.3758	296.8160	318.8465 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930 (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)	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600 (71)
Water heating gains (Table 5)	68.2014	66.0404	61.5529	55.4520	51.4912	45.9141	41.1737	47.2474	49.4054	55.7199	62.8501	66.0495 (72)
Total internal gains	557.5300	552.8719	530.8226	496.8012	462.0420	431.0413	413.0643	421.6351	441.3548	475.5900	513.5184	542.1414 (73)

6. Solar gains

[Jan]				Area	Solar flux	g		FF				Access	Gains	
				m2	Table 6a	Specific data		Specific data				factor	W	
					W/m2	or Table 6b		or Table 6c				Table 6d		
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	688.1931	775.4395	835.3493	874.1245	884.6756	850.6187	817.5817	792.3490	771.0928	721.5746	670.0227	653.9618	(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	39.5621	39.7433	39.9262	40.8666	41.0600	42.0551	42.0551	42.2600	41.6513	41.0600	40.6750	40.2971
alpha	3.6375	3.6496	3.6617	3.7244	3.7373	3.8037	3.8037	3.8173	3.7768	3.7373	3.7117	3.6865
util living area	0.9499	0.9237	0.8812	0.8020	0.6838	0.5207	0.3846	0.4111	0.6038	0.8160	0.9214	0.9565 (86)
MIT	19.7760	19.9948	20.2785	20.6036	20.8295	20.9560	20.9891	20.9860	20.9199	20.6392	20.1718	19.7459 (87)
Th 2	20.1309	20.1345	20.1382	20.1564	20.1600	20.1783	20.1783	20.1820	20.1710	20.1600	20.1527	20.1454 (88)
util rest of house	0.9421	0.9123	0.8635	0.7735	0.6402	0.4616	0.3155	0.3415	0.5449	0.7837	0.9078	0.9497 (89)
MIT 2	18.5119	18.8248	19.2261	19.6843	19.9786	20.1409	20.1717	20.1730	20.0979	19.7431	19.0944	18.4792 (90)
Living area fraction	19.0872	19.3572	19.7051	20.1027	20.3658	20.5118	20.5437	20.5430	20.4720	20.1509	19.5847	19.0557 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0872	19.3572	19.7051	20.1027	20.3658	20.5118	20.5437	20.5430	20.4720	20.1509	19.5847	19.0557 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9306	0.9002	0.8536	0.7716	0.6513	0.4861	0.3465	0.3726	0.5670	0.7833	0.8971	0.9389 (94)
Useful gains	640.4116	698.0692	713.0307	674.4667	576.1995	413.4521	283.3232	295.2338	437.1865	565.2016	601.0964	613.9773 (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	1143.1676	1112.5652	1011.5479	838.4135	645.5008	429.9410	286.8096	299.8408	467.8960	711.4298	938.7654	1127.5168 (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)

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Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	374.0505	278.5414	222.0968	118.0417	51.5601	0.0000	0.0000	0.0000	0.0000	108.7930	243.1217	382.0734 (98)
Space heating												1778.2786 (98)
Space heating per m2												(98) / (4) = 21.6969 (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												1778.2786 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	374.0505	278.5414	222.0968	118.0417	51.5601	0.0000	0.0000	0.0000	0.0000	108.7930	243.1217	382.0734 (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)	374.0505	278.5414	222.0968	118.0417	51.5601	0.0000	0.0000	0.0000	0.0000	108.7930	243.1217	382.0734 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (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	51.3891	45.1660	47.1314	41.8301	40.6880	35.9191	34.0807	37.9703	38.0828	43.3960	46.4149	50.0110 (219)
Water heating fuel used												512.0792 (219)
Annual totals kWh/year												
Space heating fuel - main system												1778.2786 (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)												157.4861 (230a)
Total electricity for the above, kWh/year												157.4861 (231)
Electricity for lighting (calculated in Appendix L)												376.4562 (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												2063.8074 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1778.2786	13.1900	234.5550 (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)	512.0792	13.1900	67.5432 (247)
Mechanical ventilation fans	157.4861	13.1900	20.7724 (249)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	376.4562	13.1900	49.6546 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-760.4928	13.1900	-100.3090 (252)
Total energy cost			272.2162 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.9005 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	87.4377
SAP rating (Section 12)		87 (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
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FULL SAP CALCULATION PRINTOUT

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Space heating - main system 1	1778.2786	0.5190	922.9266 (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)	512.0792	0.5190	265.7691 (264)
Space and water heating			1188.6957 (265)
Pumps and fans	157.4861	0.5190	81.7353 (267)
Energy for lighting	376.4562	0.5190	195.3808 (268)
Energy saving/generation technologies			
PV Unit	-760.4928	0.5190	-394.6958 (269)
Total kg/year			1071.1161 (272)
CO2 emissions per m2			13.0700 (273)
EI value			88.6949
EI rating			89 (274)
EI band			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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.9800 (1b)	x 2.4000 (2b)	= 98.3520 (1b) - (3b)
First floor	40.9800 (1c)	x 2.1000 (2c)	= 86.0580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.4100 (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					1 (19)							
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)							
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2317 (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)
	0.2433	0.2259	0.2317	0.2143	0.2143	0.1912	0.1912	0.1854	0.1854	0.2027	0.2027	0.2201 (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	0.4118	0.3944	0.4002	0.3828	0.3828	0.3597	0.3597	0.3539	0.3539	0.3712	0.3712	0.3886 (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			40.9800	0.1200	4.9176	110.0000	4507.8000	(28a)
External Walls	45.5600	13.6800	31.8800	0.1600	5.1008	60.0000	1912.8000	(29a)
Rear Wall	15.9600		15.9600	0.2700	4.3092	9.0000	143.6400	(29a)
External Walls to Commercial	14.7900		14.7900	0.0800	1.1832	60.0000	887.4000	(29a)
Sloping Roof	21.1000		21.1000	0.1000	2.1100	9.0000	189.9000	(30)
Flat Roof	28.0000		28.0000	0.1000	2.8000	9.0000	252.0000	(30)
Total net area of external elements Aum(A, m2)			166.3900					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	35.7861			(33)
Party Wall			27.7600	0.0000	0.0000	20.0000	555.2000	(32)
Internal Wall - Ground Floor			49.3800			9.0000	444.4200	(32c)
Internal Wall - First			71.3000			9.0000	641.7000	(32c)
Internal Floor			40.9900			18.0000	737.8200	(32d)
Internal Ceiling			40.9900			18.0000	737.8200	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11010.5000	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.3399	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2892	(36)
Total fabric heat loss						(33) + (36) =	49.0753	(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	25.0601	24.0025	24.3551	23.2975	23.2975	21.8874	21.8874	21.5349	21.5349	22.5924	22.5924	23.6500 (38)
Heat transfer coeff	74.1354	73.0778	73.4304	72.3728	72.3728	70.9627	70.9627	70.6102	70.6102	71.6677	71.6677	72.7253 (39)
Average = Sum(39)m / 12 =												72.0496 (39)
HLP	0.9045	0.8916	0.8959	0.8830	0.8830	0.8658	0.8658	0.8615	0.8615	0.8744	0.8744	0.8873 (40)
HLP (average)												0.8791 (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	2.4990 (42)
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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

Average daily hot water use (litres/day)												93.5512 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.9063	99.1643	95.4222	91.6802	87.9381	84.1961	84.1961	87.9381	91.6802	95.4222	99.1643	102.9063 (44)
Energy conte	152.6071	133.4712	137.7303	120.0766	115.2164	99.4230	92.1300	105.7205	106.9832	124.6785	136.0964	147.7919 (45)
Energy content (annual)										Total =	Sum(45)m =	1471.9250 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	22.8911	20.0207	20.6595	18.0115	17.2825	14.9134	13.8195	15.8581	16.0475	18.7018	20.4145	22.1688 (46)
Water storage loss:												
Store volume												
a) If manufacturer declared loss factor is known (kWh/day):												
Temperature factor from Table 2b												
Enter (49) or (54) in (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												
	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (64)
									Total per year (kWh/year) = Sum(64)m =			
									1789.2560 (64)			
Heat gains from water heating, kWh/month	50.7419	44.3792	45.7953	39.9255	38.3094	33.0581	30.6332	35.1521	35.5719	41.4556	45.2520	49.1408 (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	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2913	47.3328	38.4937	29.1422	21.7841	18.3911	19.8722	25.8306	34.6698	44.0213	51.3794	54.7724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.5643	337.0256	328.3031	309.7340	286.2937	264.2632	249.5455	246.0841	254.8066	273.3758	296.8160	318.8465 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930 (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)	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600 (71)
Water heating gains (Table 5)	68.2014	66.0404	61.5529	55.4520	51.4912	45.9141	41.1737	47.2474	49.4054	55.7199	62.8501	66.0495 (72)
Total internal gains	557.5300	552.8719	530.8226	496.8012	462.0420	431.0413	413.0643	421.6351	441.3548	475.5900	513.5184	542.1414 (73)

6. Solar gains

[Jan]				Area	Solar flux		g	FF		Access		Gains
				m2	Table 6a		Specific data	Specific data		factor		W
					W/m2		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	710.0583	779.8427	839.7776	887.8291	891.5334	883.4673	846.4608	824.6723	798.6916	744.9341	693.4566	673.4643 (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	41.2552	41.8523	41.6513	42.2600	42.2600	43.0997	43.0997	43.3149	43.3149	42.6757	42.6757	42.0551
alpha	3.7503	3.7902	3.7768	3.8173	3.8173	3.8733	3.8733	3.8877	3.8877	3.8450	3.8450	3.8037
util living area	0.9358	0.9091	0.8555	0.7549	0.6165	0.4166	0.2835	0.2977	0.5229	0.7609	0.8941	0.9433 (86)
MIT	19.9860	20.1731	20.4395	20.7254	20.9002	20.9842	20.9974	20.9968	20.9603	20.7623	20.3744	19.9676 (87)
Th 2	20.1636	20.1746	20.1710	20.1820	20.1820	20.1966	20.1966	20.2003	20.2003	20.1893	20.1893	20.1783 (88)
util rest of house	0.9259	0.8958	0.8346	0.7218	0.5683	0.3567	0.2172	0.2306	0.4630	0.7224	0.8764	0.9344 (89)
MIT 2	18.8350	19.1062	19.4739	19.8651	20.0821	20.1852	20.1955	20.1989	20.1670	19.9257	19.4048	18.8200 (90)
Living area fraction										fLA = Living area / (4) =		0.4551 (91)
MIT	19.3588	19.5917	19.9134	20.2566	20.4544	20.5488	20.5604	20.5620	20.5280	20.3064	19.8461	19.3423 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3588	19.5917	19.9134	20.2566	20.4544	20.5488	20.5604	20.5620	20.5280	20.3064	19.8461	19.3423 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9146	0.8850	0.8275	0.7250	0.5848	0.3832	0.2473	0.2611	0.4880	0.7283	0.8679	0.9235 (94)
Ext temp.	649.4150	690.1812	694.9290	643.6468	521.3957	338.5832	209.3650	215.3344	389.7555	542.5648	601.8662	621.9762 (95)
Heat loss rate W	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)
Month fracti	1064.4977	1029.7933	926.2036	756.7756	561.2075	344.0858	210.0808	216.2117	404.4552	638.3034	856.1483	1043.0485 (97)
1.0000	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	308.8215	228.2193	172.0683	81.4527	29.6200	0.0000	0.0000	0.0000	0.0000	71.2295	183.0831	313.2778 (98)
Space heating												1387.7723 (98)
Space heating per m2											(98) / (4) =	16.9323 (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												1387.7723 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	308.8215	228.2193	172.0683	81.4527	29.6200	0.0000	0.0000	0.0000	0.0000	71.2295	183.0831	313.2778 (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)	308.8215	228.2193	172.0683	81.4527	29.6200	0.0000	0.0000	0.0000	0.0000	71.2295	183.0831	313.2778 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (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)
Fuel for water heating, kWh/month	51.3891	45.1660	47.1314	41.8301	40.6880	35.9191	34.0807	37.9703	38.0828	43.3960	46.4149	50.0110 (219)
Water heating fuel used												512.0792 (219)
Annual totals kWh/year												
Space heating fuel - main system												1387.7723 (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)												157.4861 (230a)
Total electricity for the above, kWh/year												157.4861 (231)
Electricity for lighting (calculated in Appendix L)												376.4562 (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												1597.7683 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1387.7723	24.1800	335.5633 (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)	512.0792	24.1800	123.8208 (247)	
Mechanical ventilation fans	157.4861	24.1800	38.0801 (249)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Energy for lighting	376.4562	24.1800	91.0271 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-836.0256	24.1800	-202.1510 (252)	
Total energy cost			386.3404 (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	1387.7723	0.5190	720.2538 (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)	512.0792	0.5190	265.7691 (264)	
Space and water heating			986.0229 (265)	
Pumps and fans	157.4861	0.5190	81.7353 (267)	
Energy for lighting	376.4562	0.5190	195.3808 (268)	
Energy saving/generation technologies				
PV Unit	-836.0256	0.5190	-433.8973 (269)	
Total kg/year			829.2417 (272)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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	1387.7723	3.0700	4260.4609 (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)	512.0792	3.0700	1572.0832 (264)
Space and water heating			5832.5441 (265)
Pumps and fans	157.4861	3.0700	483.4824 (267)
Energy for lighting	376.4562	3.0700	1155.7206 (268)
Energy saving/generation technologies			
PV Unit	-836.0256	3.0700	-2566.5986 (269)
Primary energy kWh/year			4905.1486 (272)
Primary energy kWh/m2/year			59.8481 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 48	-103 kg (12.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£48 1.26 kg/m²	B 89	B 90
Total Savings	£48 1.26 kg/m²		

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

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	Potential	Saving
Electricity	£588	£540	£48
Space heating	£374	£374	£0
Water heating	£124	£76	£48
Lighting	£91	£91	£0
Generated (PV)	-£202	-£202	£0
Total cost of fuels	£386	£338	£48
Total cost of uses	£387	£339	£48
Delivered energy	19 kWh/m²	17 kWh/m²	2 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.7 tonnes	0.1 tonnes
CO2 emissions per m²	10 kg/m²	9 kg/m²	1 kg/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Primary energy 60 kWh/m² 52 kWh/m² 7 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	40.9800 (1b)	x 2.4000 (2b)	= 98.3520 (1b) - (3b)
First floor	40.9800 (1c)	x 2.1000 (2c)	= 86.0580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.4100 (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											1	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2317 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.2954	0.2896	0.2838	0.2549	0.2491	0.2201	0.2201	0.2143	0.2317	0.2491	0.2607	0.2723 (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) =												66.3000 (23c)
Effective ac	0.4639	0.4581	0.4523	0.4234	0.4176	0.3886	0.3886	0.3828	0.4002	0.4176	0.4292	0.4408 (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			40.9800	0.1200	4.9176	110.0000	4507.8000 (28a)
External Walls	45.5600	13.6800	31.8800	0.1600	5.1008	60.0000	1912.8000 (29a)
Rear Wall	15.9600		15.9600	0.2700	4.3092	9.0000	143.6400 (29a)
External Walls to Commercial	14.7900		14.7900	0.0800	1.1832	60.0000	887.4000 (29a)
Sloping Roof	21.1000		21.1000	0.1000	2.1100	9.0000	189.9000 (30)
Flat Roof	28.0000		28.0000	0.1000	2.8000	9.0000	252.0000 (30)
Total net area of external elements Aum(A, m ²)			166.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.7861		(33)
Party Wall			27.7600	0.0000	0.0000	20.0000	555.2000 (32)
Internal Wall - Ground Floor			49.3800			9.0000	444.4200 (32c)
Internal Wall - First			71.3000			9.0000	641.7000 (32c)
Internal Floor			40.9900			18.0000	737.8200 (32d)
Internal Ceiling			40.9900			18.0000	737.8200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11010.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.3399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2892 (36)
Total fabric heat loss						(33) + (36) =	49.0753 (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	28.2328	27.8803	27.5278	25.7651	25.4126	23.6500	23.6500	23.2975	24.3551	25.4126	26.1177	26.8227 (38)
Heat transfer coeff	77.3081	76.9556	76.6031	74.8405	74.4879	72.7253	72.7253	72.3728	73.4304	74.4879	75.1930	75.8980 (39)
Average = Sum(39)m / 12 =												74.7523 (39)
HLP	0.9432	0.9389	0.9346	0.9131	0.9088	0.8873	0.8873	0.8830	0.8959	0.9088	0.9174	0.9260 (40)
HLP (average)												0.9121 (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 2.4990 (42)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Average daily hot water use (litres/day)												93.5512 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.9063	99.1643	95.4222	91.6802	87.9381	84.1961	84.1961	87.9381	91.6802	95.4222	99.1643	102.9063 (44)
Energy content (annual)	152.6071	133.4712	137.7303	120.0766	115.2164	99.4230	92.1300	105.7205	106.9832	124.6785	136.0964	147.7919 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8911	20.0207	20.6595	18.0115	17.2825	14.9134	13.8195	15.8581	16.0475	18.7018	20.4145	22.1688 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (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												1.2321 (H8)
Utilisation factor												0.5559 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.5512 (H14)
Volume ratio Veff/V												0.8017 (H15)
Solar storage volume factor												0.9558 (H16)
Solar input												-847.2314 (H17)
Solar input	-24.5680	-40.9970	-69.8225	-93.5759	-115.6052	-113.6583	-112.1563	-97.9915	-76.7470	-52.4092	-29.1412	-20.5592 (63)
Output from w/h	Solar input (sum of months) = Sum(63)m =											-847.2314 (63)
	154.9905	116.8174	94.8592	52.5827	26.5626	11.8466	6.9251	34.6804	56.3182	99.2208	133.0372	154.1840 (64)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m =											942.0246 (64)
	50.7419	44.3792	45.7953	39.9255	38.3094	33.0581	30.6332	35.1521	35.5719	41.4556	45.2520	49.1408 (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	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2913	47.3328	38.4937	29.1422	21.7841	18.3911	19.8722	25.8306	34.6698	44.0213	51.3794	54.7724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.5643	337.0256	328.3031	309.7340	286.2937	264.2632	249.5455	246.0841	254.8066	273.3758	296.8160	318.8465 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930 (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)	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600 (71)
Water heating gains (Table 5)	68.2014	66.0404	61.5529	55.4520	51.4912	45.9141	41.1737	47.2474	49.4054	55.7199	62.8501	66.0495 (72)
Total internal gains	557.5300	552.8719	530.8226	496.8012	462.0420	431.0413	413.0643	421.6351	441.3548	475.5900	513.5184	542.1414 (73)

6. Solar gains

[Jan]												Gains
	Area				Solar flux		g		FF		Access	Gains
	m2				Table 6a		Specific data		Specific data		factor	W
					W/m2		or Table 6b		or Table 6c		Table 6d	
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	688.1931	775.4395	835.3493	874.1245	884.6756	850.6187	817.5817	792.3490	771.0928	721.5746	670.0227	653.9618 (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	39.5621	39.7433	39.9262	40.8666	41.0600	42.0551	42.0551	42.2600	41.6513	41.0600	40.6750	40.2971
alpha	3.6375	3.6496	3.6617	3.7244	3.7373	3.8037	3.8037	3.8173	3.7768	3.7373	3.7117	3.6865
util living area	0.9499	0.9237	0.8812	0.8020	0.6838	0.5207	0.3846	0.4111	0.6038	0.8160	0.9214	0.9565 (86)
MIT	19.7760	19.9948	20.2785	20.6036	20.8295	20.9560	20.9891	20.9860	20.9199	20.6392	20.1718	19.7459 (87)
Th 2	20.1309	20.1345	20.1382	20.1564	20.1600	20.1783	20.1783	20.1820	20.1710	20.1600	20.1527	20.1454 (88)
util rest of house	0.9421	0.9123	0.8635	0.7735	0.6402	0.4616	0.3155	0.3415	0.5449	0.7837	0.9078	0.9497 (89)

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MIT 2	18.5119	18.8248	19.2261	19.6843	19.9786	20.1409	20.1717	20.1730	20.0979	19.7431	19.0944	18.4792 (90)
Living area fraction									fLA = Living area / (4) =			0.4551 (91)
MIT	19.0872	19.3572	19.7051	20.1027	20.3658	20.5118	20.5437	20.5430	20.4720	20.1509	19.5847	19.0557 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0872	19.3572	19.7051	20.1027	20.3658	20.5118	20.5437	20.5430	20.4720	20.1509	19.5847	19.0557 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9306	0.9002	0.8536	0.7716	0.6513	0.4861	0.3465	0.3726	0.5670	0.7833	0.8971	0.9389 (94)
Useful gains	640.4116	698.0692	713.0307	674.4667	576.1995	413.4521	283.3232	295.2338	437.1865	565.2016	601.0964	613.9773 (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												
	1143.1676	1112.5652	1011.5479	838.4135	645.5008	429.9410	286.8096	299.8408	467.8960	711.4288	938.7654	1127.5168 (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												
	374.0505	278.5414	222.0968	118.0417	51.5601	0.0000	0.0000	0.0000	0.0000	108.7930	243.1217	382.0734 (98)
Space heating												1778.2786 (98)
Space heating per m2												21.6969 (99)
										(98) / (4) =		

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													1778.2786 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	374.0505	278.5414	222.0968	118.0417	51.5601	0.0000	0.0000	0.0000	0.0000	108.7930	243.1217	382.0734 (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)	374.0505	278.5414	222.0968	118.0417	51.5601	0.0000	0.0000	0.0000	0.0000	108.7930	243.1217	382.0734 (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	154.9905	116.8174	94.8592	52.5827	26.5626	11.8466	6.9251	34.6804	56.3182	99.2208	133.0372	154.1840 (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)	
Fuel for water heating, kWh/month	44.3578	33.4328	27.1484	15.0490	7.6021	3.3905	1.9819	9.9254	16.1181	28.3967	38.0748	44.1270 (219)	
Water heating fuel used												269.6044 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1778.2786 (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)													157.4861 (230a)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													207.4861 (231)
Electricity for lighting (calculated in Appendix L)													376.4562 (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													1871.3326 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1778.2786	13.1900	234.5550 (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)	269.6044	13.1900	35.5608 (247)	
Mechanical ventilation fans	157.4861	13.1900	20.7724 (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	376.4562	13.1900	49.6546 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-760.4928	13.1900	-100.3090 (252)	

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Total energy cost 246.8288 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
 Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] =$ 0.8165 (257)
 SAP value 88.6092
 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	1778.2786	0.5190	922.9266 (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)	269.6044	0.5190	139.9247 (264)
Space and water heating			1062.8513 (265)
Pumps and fans	207.4861	0.5190	107.6853 (267)
Energy for lighting	376.4562	0.5190	195.3808 (268)
Energy saving/generation technologies			
PV Unit	-760.4928	0.5190	-394.6958 (269)
Total kg/year			971.2216 (272)
CO2 emissions per m2			11.8500 (273)
EI value			89.7492
EI rating			90 (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	40.9800 (1b)	x 2.4000 (2b)	= 98.3520 (1b) - (3b)
First floor	40.9800 (1c)	x 2.1000 (2c)	= 86.0580 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 184.4100 (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					1 (19)							
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)							
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2317 (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)
	0.2433	0.2259	0.2317	0.2143	0.2143	0.1912	0.1912	0.1854	0.1854	0.2027	0.2027	0.2201 (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	0.4118	0.3944	0.4002	0.3828	0.3828	0.3597	0.3597	0.3539	0.3539	0.3712	0.3712	0.3886 (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			40.9800	0.1200	4.9176	110.0000	4507.8000 (28a)
External Walls	45.5600	13.6800	31.8800	0.1600	5.1008	60.0000	1912.8000 (29a)
Rear Wall	15.9600		15.9600	0.2700	4.3092	9.0000	143.6400 (29a)
External Walls to Commercial	14.7900		14.7900	0.0800	1.1832	60.0000	887.4000 (29a)
Sloping Roof	21.1000		21.1000	0.1000	2.1100	9.0000	189.9000 (30)
Flat Roof	28.0000		28.0000	0.1000	2.8000	9.0000	252.0000 (30)
Total net area of external elements Aum(A, m ²)			166.3900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		35.7861		(33)
Party Wall			27.7600	0.0000	0.0000	20.0000	555.2000 (32)
Internal Wall - Ground Floor			49.3800			9.0000	444.4200 (32c)
Internal Wall - First			71.3000			9.0000	641.7000 (32c)
Internal Floor			40.9900			18.0000	737.8200 (32d)
Internal Ceiling			40.9900			18.0000	737.8200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11010.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.3399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2892 (36)
Total fabric heat loss						(33) + (36) =	49.0753 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 25.0601	Feb 24.0025	Mar 24.3551	Apr 23.2975	May 23.2975	Jun 21.8874	Jul 21.8874	Aug 21.5349	Sep 21.5349	Oct 22.5924	Nov 22.5924	Dec 23.6500 (38)
Heat transfer coeff	74.1354	73.0778	73.4304	72.3728	72.3728	70.9627	70.9627	70.6102	70.6102	71.6677	71.6677	72.7253 (39)
Average = Sum(39)m / 12 =												72.0496 (39)
HLP	Jan 0.9045	Feb 0.8916	Mar 0.8959	Apr 0.8830	May 0.8830	Jun 0.8658	Jul 0.8658	Aug 0.8615	Sep 0.8615	Oct 0.8744	Nov 0.8744	Dec 0.8873 (40)
HLP (average)												0.8791 (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	2.4990 (42)
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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

Average daily hot water use (litres/day)												93.5512 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.9063	99.1643	95.4222	91.6802	87.9381	84.1961	84.1961	87.9381	91.6802	95.4222	99.1643	102.9063 (44)
Energy content (annual)	152.6071	133.4712	137.7303	120.0766	115.2164	99.4230	92.1300	105.7205	106.9832	124.6785	136.0964	147.7919 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8911	20.0207	20.6595	18.0115	17.2825	14.9134	13.8195	15.8581	16.0475	18.7018	20.4145	22.1688 (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	179.5585	157.8144	164.6817	146.1586	142.1678	125.5050	119.0814	132.6719	133.0652	151.6299	162.1784	174.7433 (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												1.3346 (H8)
Utilisation factor												0.5273 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												93.5512 (H14)
Volume ratio Veff/V												0.8017 (H15)
Solar storage volume factor												0.9558 (H16)
Solar input												-870.5504 (H17)
Solar input	-27.7831	-40.5559	-68.6717	-93.5854	-112.7806	-117.3539	-115.1898	-102.5869	-80.5158	-55.6763	-32.4741	-23.3770 (63)
Output from w/h	Solar input (sum of months) = Sum(63)m =											-870.5504 (63)
	151.7754	117.2584	96.0100	52.5733	29.3872	8.1511	3.8916	30.0850	52.5493	95.9537	129.7043	151.3663 (64)
	Total per year (kWh/year) = Sum(64)m =											918.7056 (64)
Heat gains from water heating, kWh/month	50.7419	44.3792	45.7953	39.9255	38.3094	33.0581	30.6332	35.1521	35.5719	41.4556	45.2520	49.1408 (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	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399	149.9399 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2913	47.3328	38.4937	29.1422	21.7841	18.3911	19.8722	25.8306	34.6698	44.0213	51.3794	54.7724 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	333.5643	337.0256	328.3031	309.7340	286.2937	264.2632	249.5455	246.0841	254.8066	273.3758	296.8160	318.8465 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930	52.4930 (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)	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600	-99.9600 (71)
Water heating gains (Table 5)	68.2014	66.0404	61.5529	55.4520	51.4912	45.9141	41.1737	47.2474	49.4054	55.7199	62.8501	66.0495 (72)
Total internal gains	557.5300	552.8719	530.8226	496.8012	462.0420	431.0413	413.0643	421.6351	441.3548	475.5900	513.5184	542.1414 (73)

6. Solar gains

[Jan]														
	Area				Solar flux		g		FF		Access		Gains	
	m2				Table 6a		Specific data		Specific data		factor		W	
					W/m2		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	710.0583	779.8427	839.7776	887.8291	891.5334	883.4673	846.4608	824.6723	798.6916	744.9341	693.4566	673.4643	(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	41.2552	41.8523	41.6513	42.2600	42.2600	43.0997	43.0997	43.3149	43.3149	42.6757	42.6757	42.0551
alpha	3.7503	3.7902	3.7768	3.8173	3.8173	3.8733	3.8733	3.8877	3.8877	3.8450	3.8450	3.8037
util living area	0.9358	0.9091	0.8555	0.7549	0.6165	0.4166	0.2835	0.2977	0.5229	0.7609	0.8941	0.9433 (86)
MIT	19.9860	20.1731	20.4395	20.7254	20.9002	20.9842	20.9974	20.9968	20.9603	20.7623	20.3744	19.9676 (87)
Th 2	20.1636	20.1746	20.1710	20.1820	20.1820	20.1966	20.1966	20.2003	20.2003	20.1893	20.1893	20.1783 (88)
util rest of house	0.9259	0.8958	0.8346	0.7218	0.5683	0.3567	0.2172	0.2306	0.4630	0.7224	0.8764	0.9344 (89)

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MIT 2	18.8350	19.1062	19.4739	19.8651	20.0821	20.1852	20.1955	20.1989	20.1670	19.9257	19.4048	18.8200 (90)
Living area fraction									fLA = Living area / (4) =			0.4551 (91)
MIT	19.3588	19.5917	19.9134	20.2566	20.4544	20.5488	20.5604	20.5620	20.5280	20.3064	19.8461	19.3423 (92)
Temperature adjustment												0.0000
adjusted MIT	19.3588	19.5917	19.9134	20.2566	20.4544	20.5488	20.5604	20.5620	20.5280	20.3064	19.8461	19.3423 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9146	0.8850	0.8275	0.7250	0.5848	0.3832	0.2473	0.2611	0.4880	0.7283	0.8679	0.9235 (94)	
Useful gains	649.4150	690.1812	694.9290	643.6468	521.3957	338.5832	209.3650	215.3344	389.7555	542.5648	601.8662	621.9762 (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	1064.4977	1029.7933	926.2036	756.7756	561.2075	344.0858	210.0808	216.2117	404.4552	638.3034	856.1483	1043.0485 (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	308.8215	228.2193	172.0683	81.4527	29.6200	0.0000	0.0000	0.0000	0.0000	71.2295	183.0831	313.2778 (98)	
Space heating												1387.7723 (98)	
Space heating per m2										(98) / (4) =		16.9323 (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													1387.7723 (211)
Space heating requirement	308.8215	228.2193	172.0683	81.4527	29.6200	0.0000	0.0000	0.0000	0.0000	71.2295	183.0831	313.2778 (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)	308.8215	228.2193	172.0683	81.4527	29.6200	0.0000	0.0000	0.0000	0.0000	71.2295	183.0831	313.2778 (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	151.7754	117.2584	96.0100	52.5733	29.3872	8.1511	3.8916	30.0850	52.5493	95.9537	129.7043	151.3663 (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	43.4376	33.5590	27.4778	15.0463	8.4105	2.3328	1.1138	8.6102	15.0394	27.4616	37.1209	43.3205 (219)	
Water heating fuel used												262.9305 (219)	
Annual totals kWh/year													
Space heating fuel - main system												1387.7723 (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)													157.4861 (230a)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													207.4861 (231)
Electricity for lighting (calculated in Appendix L)													376.4562 (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													1398.6196 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1387.7723	24.1800	335.5633 (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)	262.9305	24.1800	63.5766 (247)	
Mechanical ventilation fans	157.4861	24.1800	38.0801 (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	376.4562	24.1800	91.0271 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-836.0256	24.1800	-202.1510 (252)	

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Total energy cost 338.1862 (255)

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	1387.7723	0.5190	720.2538 (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)	262.9305	0.5190	136.4609 (264)
Space and water heating			856.7148 (265)
Pumps and fans	207.4861	0.5190	107.6853 (267)
Energy for lighting	376.4562	0.5190	195.3808 (268)
Energy saving/generation technologies			
PV Unit	-836.0256	0.5190	-433.8973 (269)
Total kg/year			725.8836 (272)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	1387.7723	3.0700	4260.4609 (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)	262.9305	3.0700	807.1967 (264)
Space and water heating			5067.6576 (265)
Pumps and fans	207.4861	3.0700	636.9824 (267)
Energy for lighting	376.4562	3.0700	1155.7206 (268)
Energy saving/generation technologies			
PV Unit	-836.0256	3.0700	-2566.5986 (269)
Primary energy kWh/year			4293.7621 (272)
Primary energy kWh/m ² /year			52.3885 (273)