



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 2 Harding Road
EASTLEIGH, SO50 9RB

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

Report Issue Date: 10/02/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 216				Issued on Date	10/02/2023
Assessment Reference	AB	Prop Type Ref	Type 4.2			
Property	2 Harding Road, EASTLEIGH, SO50 9RB					
SAP Rating	88 B	DER	13.47	TER	16.87	
Environmental	89 B	% DER<TER	20.14			
CO ₂ Emissions (t/year)	1.07	DFEE	44.90	TFEE	50.38	
General Requirements Compliance	Pass	% DFEE<TFEE	10.88			
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD					

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.87	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.47	kgCO ₂ /m ²	Pass
	-3.40 (-20.2%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.38	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.90	kWh/m ² /yr	
	-5.5 (-10.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.20 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (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	5.39 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

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Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing South East

4.64 m², No overhang

Windows facing South West

1.20 m², No overhang

Windows facing North West

6.70 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

5.39 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.10

W/m²K

Photovoltaic array

1.28

kW

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 Built)

Orientation	South East
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Urban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	3
3.0 Date Built	2023
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:	18.60 m	41.13 m ²	2.40 m
1st Storey:	18.60 m	41.13 m ²	2.70 m
2nd Storey:	13.09 m	24.70 m ²	2.10 m

7.0 Living Area 14.90 m²

8.0 Thermal Mass Parameter
Thermal Mass Precise calculation
85.11 kJ/m²K

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 Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	105.46	92.13
Vertical Studwork	Timber Frame	Timber framed wall (one layer of plasterboard)	0.16	9.00	16.92	15.55

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	53.44

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - GF	Plasterboard on timber frame	9.00	47.42
Internal Wall - FF	Plasterboard on timber frame	9.00	64.20
Internal Wall - TF	Plasterboard on timber frame	9.00	23.56

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	23.93	23.93
Dormer Roof	External Flat Roof	Plasterboard, insulated flat roof	0.18	9.00	2.44	2.44
Skillings	External Slope Roof	Plasterboard, insulated slope	0.16	9.00	17.45	17.45

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	41.13
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	24.70

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Heat Loss Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.16	75.00	41.13

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	41.13
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	24.70

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Solid Doors	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] External Wall	South East							2.16	
Front Elevation	Window	[1] External Wall	South East	None	0.00					3.27	
Front Dormer	Window	[2] Vertical Studwork	South East	None	0.00					1.37	
Side Elevation	Window	[1] External Wall	South West	None	0.00					1.20	
Rear Elevation	Window	[1] External Wall	North West	None	0.00					6.70	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Source Type	Bridge Type	Length	Psi	Imported
Independently assessed	E2 Other lintels (including other steel lintels)	10.56	0.088	Yes
Table K1 - Approved	E3 Sill	9.54	0.040	Yes
Table K1 - Approved	E4 Jamb	26.90	0.050	Yes
Table K1 - Approved	E5 Ground floor (normal)	18.60	0.160	Yes
Table K1 - Approved	E6 Intermediate floor within a dwelling	31.69	0.070	Yes
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	10.26	0.060	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	4.68	0.240	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	3.60	0.040	No
Table K1 - Approved	E16 Corner (normal)	10.20	0.090	No
Table K1 - Approved	E18 Party wall between dwellings	10.20	0.060	No
Table K1 - Default	P1 Party wall - Ground floor	8.40	0.160	No
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	13.08	0.000	No
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	4.68	0.240	No
Table K1 - Default	P5 Party wall - Roof (insulation at rafter level)	3.60	0.080	No
Table K1 - Default	R6 Flat ceiling	13.21	0.060	No
Table K1 - Default	R7 Flat ceiling (inverted)	1.20	0.040	No
Table K1 - Default	R8 Roof to wall (rafter)	8.98	0.060	No
Table K1 - Default	R9 Roof to wall (flat ceiling)	1.20	0.040	No

Y-value	0.074	W/m ² K
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18.0 Pressure Testing	Yes	
Designed AP ₅₀	6.00	m ³ /(h.m ²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	5.39	m ³ /(h.m ²) @ 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	No

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				4
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No
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22.0 Lighting	
Internal	
Total number of light fittings	17
Total number of L.E.L. fittings	17
Percentage of L.E.L. fittings	100.00
External	
External lights fitted	No

23.0 Electricity Tariff	Standard
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24.0 Main Heating 1	Database
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SUMMARY FOR INPUT DATA

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Description	Gas Boiler	
Percentage of Heat	100	%
Database Ref. No.	17929	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	No
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901

29.0 Hot Water Cylinder	None
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32.0 Photovoltaic Unit	One Dwelling			
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.28	North West	45°	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	£32	B 89	

U-VALUE CALCULATOR REPORT

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Building Elements

Roof Pitched Roof - 400mm Quilt

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Mineral wool				
	Main construction	300	0.0400	7.5000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Mineral wool				
	Main construction	100	0.0400	2.5000	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 10.046 m ² K/W	Lower limit = 9.832 m ² K/W	Average = 9.939 m ² K/W
	Total correction = 0.0005 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 416 mm

U-value: 0.10 W/m² K

Kappa: n/a

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Client	Highwood Construction Ltd, HIGHWOOD
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Building Elements

Roof Skilling Ceiling

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	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Celotex GA4000				
	Main construction	50	0.0220	2.2727	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 6.439 m ² K/W	Lower limit = 5.763 m ² K/W	Average = 6.101 m ² K/W
	Total correction = 0.0043 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

Unheated space: None

Total thickness: 166 mm

U-value: 0.16 W/m² K

Kappa: n/a

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Building Elements

Wall External Walls - Stoneham - TF

Wall Type: Timber framed Wall with I-beams

U-VALUE CALCULATOR REPORT

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.2900	
Layer 1	Brick, outer leaf				
	Main construction	100	0.7700	0.0000	82.81
	Main construction	100	0.9407	0.0000	17.19
Layer 2	Standard cavity				
	Main construction	50	0.0000	0.0000	100.00
	Corrections - Cavity Ventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 3	Breather membrane				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 5	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 6	Celotex GA4000				
	Main construction	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 8	Polythene, 500 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 9	Service Void				
	Main construction	25	0.0321	0.7800	89.63
	Main construction	25	0.1300	0.1923	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 11	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance: Upper limit = 5.477 m² K/W Lower limit = 4.778 m² K/W Average = 5.128 m² K/W
Total correction = 0.0041 m² K/W U-value (unrounded) = 0.2 W/m² K

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

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Building Elements

Wall Studwork

Wall Type: Timber framed Wall with I-beams

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	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Celotex GA4000				
	Main construction	50	0.0220	2.2727	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 6.471 m ² K/W	Lower limit = 5.793 m ² K/W	Average = 6.132 m ² K/W
	Total correction = 0.0042 m ² K/W	U-value (unrounded) = 0.16 W/m ² K	

Unheated space: None

Total thickness: 166 mm

U-value: 0.16 W/m² K

Kappa: n/a

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Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

Area = 41.13 m², Perimeter = 18.60 m, Wall thickness = 275.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 m

U-value of walls above ground: U_w = 1.500 m

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	Blockwork, dense				
	Main construction	100	1.5900	0.0629	82.95
	Main construction	100	2.2000	0.0455	17.05
Layer 2	Jablite Jabfloor (HP)				
	Main construction	150	0.0320	4.6875	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 = 5.153 m² K/W Lower limit = 5.152 m² K/W Average = 5.152 m² K/W

Total correction = 0.0083 m² K/W

U-value (unrounded) = 0.16 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.16 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS BUILT

Semi-Detached House, total floor area 107 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.87 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.47 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 44.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.20 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.18 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.39 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESPl 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing South East: 4.64 m², No overhang
Windows facing South West: 1.20 m², No overhang
Windows facing North West: 6.70 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Photovoltaic array 1.28 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.3900
Infiltration rate					0.4224 (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) =				0.3907 (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	0.4982	0.4884	0.4786	0.4298	0.4200	0.3712	0.3712	0.3614	0.3907	0.4200	0.4395	0.4591 (22b)
Effective ac	0.6241	0.6193	0.6145	0.5924	0.5882	0.5689	0.5689	0.5653	0.5763	0.5882	0.5966	0.6054 (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
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			12.5400	1.3258	16.6250		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	13.3300	92.1300	0.2000	18.4260	9.0000	829.1700 (29a)
Vertical Studwork	16.9200	1.3700	15.5500	0.1600	2.4880	9.0000	139.9500 (29a)
External Roof	23.9300		23.9300	0.1000	2.3930	9.0000	215.3700 (30)
Dormer Roof	2.4400		2.4400	0.1800	0.4392	9.0000	21.9600 (30)
Skellings	17.4500		17.4500	0.1600	2.7920	9.0000	157.0500 (30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.7680		(33)
Party Wall			53.4400	0.0000	0.0000	20.0000	1068.8000 (32)
Internal Wall - GF			47.4200			9.0000	426.7800 (32c)
Internal Wall - FF			64.2000			9.0000	577.8000 (32c)
Internal Wall - TF			23.5600			9.0000	212.0400 (32c)
Internal Floor			41.1300			18.0000	740.3400 (32d)
Internal Floor			24.7000			18.0000	444.6000 (32d)
Internal Ceiling			41.1300			18.0000	740.3400 (32e)
Internal Ceiling			24.7000			18.0000	444.6000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				9103.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.1117 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4456 (36)
Total fabric heat loss						(33) + (36) =	68.2136 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	53.8822	53.4662	53.0584	51.1432	50.7849	49.1168	49.1168	48.8079	49.7593	50.7849	51.5098	52.2676 (38)
Heat transfer coeff	122.0957	121.6797	121.2720	119.3568	118.9985	117.3304	117.3304	117.0215	117.9729	118.9985	119.7234	120.4812 (39)
Average = Sum(39)m / 12 =												119.3551 (39)
HLP	1.1415	1.1376	1.1338	1.1159	1.1126	1.0970	1.0970	1.0941	1.1030	1.1126	1.1193	1.1264 (40)
HLP (average)												1.1159 (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	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy conte	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Energy content (annual)	Total = Sum (45)m =											1582.6444 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (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	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (64)
	Total per year (kWh/year) = Sum (64)m =											1748.3289 (64)
Heat gains from water heating, kWh/month	58.0963	50.9098	52.7681	46.3333	44.7005	38.9311	36.4304	41.2999	41.6439	48.0935	52.0719	56.3717 (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	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5683	23.5977	19.1910	14.5288	10.8604	9.1688	9.9073	12.8778	17.2846	21.9468	25.6151	27.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)	78.0864	75.7587	70.9248	64.3518	60.0814	54.0709	48.9656	55.5106	57.8387	64.6418	72.3221	75.7684 (72)
Total internal gains	439.6980	437.1714	420.9460	394.8408	368.1314	342.7876	326.6350	333.3787	347.0984	373.4337	403.5530	426.3326 (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
				4.6400	36.7938		0.6300		0.7000		0.7700		52.1753 (77)
Southeast				1.2000	36.7938		0.6300		0.7000		0.7700		13.4936 (79)
Southwest				6.7000	11.2829		0.6300		0.7000		0.7700		23.1030 (81)
Northwest													
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660	(83)
Total gains	528.4699	596.0567	658.7230	723.6235	767.5800	753.0647	716.4775	668.4041	616.0605	554.5316	511.2788	501.3985	(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	20.7113	20.7821	20.8520	21.1866	21.2504	21.5525	21.5525	21.6094	21.4351	21.2504	21.1217	20.9889
alpha	2.3808	2.3855	2.3901	2.4124	2.4167	2.4368	2.4368	2.4406	2.4290	2.4167	2.4081	2.3993
util living area	0.9699	0.9585	0.9379	0.8960	0.8226	0.7080	0.5865	0.6294	0.7991	0.9152	0.9589	0.9733 (86)
MIT	18.1905	18.4420	18.8945	19.5207	20.1155	20.5923	20.8202	20.7795	20.3991	19.6413	18.8209	18.1564 (87)
Th 2	19.9671	19.9702	19.9733	19.9879	19.9906	20.0033	20.0033	20.0057	19.9984	19.9906	19.9851	19.9793 (88)
util rest of house	0.9657	0.9527	0.9287	0.8789	0.7898	0.6459	0.4888	0.5360	0.7501	0.8981	0.9521	0.9696 (89)
MIT 2	17.3856	17.6368	18.0863	18.7102	19.2828	19.7270	19.9114	19.8863	19.5618	18.8377	18.0251	17.3599 (90)
Living area fraction	17.4977	17.7490	18.1989	18.8231	19.3988	19.8475	20.0380	20.0107	fLA = Living area / (4) =	18.9496	18.1360	17.4708 (91)
MIT	17.4977	17.7490	18.1989	18.8231	19.3988	19.8475	20.0380	20.0107	19.6784	18.9496	18.1360	17.4708 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4977	17.7490	18.1989	18.8231	19.3988	19.8475	20.0380	20.0107	19.6784	18.9496	18.1360	17.4708 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	502.8934	557.6249	597.8102	618.2521	588.6664	478.0577	352.8936	358.5852	450.5653	485.2219	478.1175	479.6751 (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	1611.3870	1563.4625	1418.7491	1184.3874	916.1415	615.6940	403.3761	422.5280	658.1042	993.5918	1321.2611	1598.8868 (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	824.7192	675.9229	610.7786	407.6174	243.6415	0.0000	0.0000	0.0000	0.0000	378.2272	607.0634	832.6935 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 4580.6636 (98)
42.8260 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 90.5000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 5061.5068 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	824.7192	675.9229	610.7786	407.6174	243.6415	0.0000	0.0000	0.0000	0.0000	378.2272	607.0634	832.6935	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	911.2919	746.8761	674.8935	450.4060	269.2171	0.0000	0.0000	0.0000	0.0000	417.9306	670.7883	920.1033	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468	(64)
Efficiency of water heater (217)m	89.9143	89.8813	89.8092	89.6478	89.3166	87.3000	87.3000	87.3000	87.3000	89.5759	89.8133	89.9328	(216)
Fuel for water heating, kWh/month	198.2296	173.8745	180.6078	159.2087	154.4178	137.9687	129.4752	146.2628	147.3258	165.3739	178.1447	192.4179	(219)
Water heating fuel used												1963.3076	(219)
Annual totals kWh/year													
Space heating fuel - main system												5061.5068	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												469.2048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 677 * 1.00) =										-692.7410		-692.7410	(233)
Total delivered energy for all uses												6876.2782	(238)

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	5061.5068	0.2160	1093.2855	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.3076	0.2160	424.0744	(264)
Space and water heating			1517.3599	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	469.2048	0.5190	243.5173	(268)
Energy saving/generation technologies				
PV Unit	-692.7410	0.5190	-359.5326	(269)
Total CO2, kg/year			1440.2696	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4700	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

	DER	TFA	N	EF	
Total Floor Area		106.9600			
Assumed number of occupants			2.7953		
CO2 emission factor in Table 12 for electricity displaced from grid			0.5190		
CO2 emissions from appliances, equation (L14)			14.7986		ZC2
CO2 emissions from cooking, equation (L16)			1.7398		ZC3
Total CO2 emissions			30.0084		ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000		ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000		ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000		ZC7
Net CO2 emissions			30.0084		ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4029 (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) =				0.3727 (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	0.4752	0.4658	0.4565	0.4099	0.4006	0.3540	0.3540	0.3447	0.3727	0.4006	0.4193	0.4379 (22b)
Effective ac	0.6129	0.6085	0.6042	0.5840	0.5802	0.5627	0.5627	0.5594	0.5694	0.5802	0.5879	0.5959 (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
TER Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.40)			12.5400	1.3258	16.6250		(27)
Heat Loss Floor			41.1300	0.1300	5.3469		(28a)
External Wall	105.4600	13.3300	92.1300	0.1800	16.5834		(29a)
Vertical Studwork	16.9200	1.3700	15.5500	0.1800	2.7990		(29a)
External Roof	23.9300		23.9300	0.1300	3.1109		(30)
Dormer Roof	2.4400		2.4400	0.1300	0.3172		(30)
Skellings	17.4500		17.4500	0.1300	2.2685		(30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				49.2109		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9894 (36)
Total fabric heat loss	(33) + (36) =						60.2003 (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	52.9159	52.5374	52.1664	50.4240	50.0980	48.5804	48.5804	48.2993	49.1649	50.0980	50.7575	51.4470 (38)
Heat transfer coeff	113.1162	112.7377	112.3667	110.6243	110.2983	108.7807	108.7807	108.4996	109.3652	110.2983	110.9578	111.6473 (39)
Average = Sum(39)m / 12 =												110.6227 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0576	1.0540	1.0505	1.0343	1.0312	1.0170	1.0170	1.0144	1.0225	1.0312	1.0374	1.0438 (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												2.7953 (42)
Average daily hot water use (litres/day)												100.5882 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy content (annual)	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Distribution loss (46)m = 0.15 x (45)m												1582.6444 (45)
	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.6130	48.1831	44.6446	46.1328	48.1831	48.6130	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	215.0453	189.5384	199.0494	177.7219	172.0662	151.5463	145.1929	161.8560	163.6436	185.0159	195.6487	209.8678	(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	215.0453	189.5384	199.0494	177.7219	172.0662	151.5463	145.1929	161.8560	163.6436	185.0159	195.6487	209.8678	(64)
Heat gains from water heating, kWh/month	67.2984	59.2243	61.9798	55.0820	53.2369	46.7060	44.4707	49.8420	50.4009	57.3137	60.9847	65.5769	(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	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5683	23.5977	19.1910	14.5288	10.8604	9.1688	9.9073	12.8778	17.2846	21.9468	25.6151	27.3067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)	90.4549	88.1313	83.3062	76.5027	71.5550	64.8694	59.7724	66.9920	70.0013	77.0345	84.7010	88.1410	(72)
Total internal gains	452.0664	449.5441	433.3273	406.9917	379.6050	353.5861	337.4417	344.8601	359.2610	385.8263	415.9318	438.7052	(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	4.6400	36.7938	0.6300	0.7000	0.7700	52.1753	(77)						
Southwest	1.2000	36.7938	0.6300	0.7000	0.7700	13.4936	(79)						
Northwest	6.7000	11.2829	0.6300	0.7000	0.7700	23.1030	(81)						
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660	(83)
Total gains	540.8383	608.4294	671.1044	735.7745	779.0536	763.8632	727.2842	679.8855	628.2231	566.9243	523.6576	513.7712	(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	65.6651	65.8855	66.1030	67.1442	67.3426	68.2821	68.2821	68.4590	67.9172	67.3426	66.9424	66.5290	
alpha	5.3777	5.3924	5.4069	5.4763	5.4895	5.5521	5.5521	5.5639	5.5278	5.4895	5.4628	5.4353	
util living area	0.9991	0.9982	0.9951	0.9826	0.9362	0.8055	0.6345	0.6938	0.9129	0.9893	0.9982	0.9994	(86)
MIT	19.7955	19.9207	20.1402	20.4479	20.7340	20.9272	20.9846	20.9754	20.8372	20.4739	20.0860	19.7803	(87)
Th 2	20.0356	20.0386	20.0414	20.0549	20.0574	20.0692	20.0692	20.0714	20.0646	20.0574	20.0523	20.0470	(88)
util rest of house	0.9988	0.9975	0.9933	0.9753	0.9075	0.7255	0.5123	0.5731	0.8623	0.9836	0.9974	0.9991	(89)
MIT 2	18.4140	18.5991	18.9216	19.3765	19.7750	20.0154	20.0628	20.0599	19.9190	19.4192	18.8511	18.3999	(90)
Living area fraction									fLA = Living area / (4) =			0.1393	(91)
MIT	18.6065	18.7832	19.0913	19.5258	19.9086	20.1424	20.1912	20.1874	20.0469	19.5662	19.0232	18.5922	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6065	18.7832	19.0913	19.5258	19.9086	20.1424	20.1912	20.1874	20.0469	19.5662	19.0232	18.5922	(93)

8. Space heating requirement													
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	539.8450	606.1452	664.7980	713.5484	702.5753	559.5646	384.8197	400.6873	540.9606	555.2010	521.6508	513.0597	(94)
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	1618.2908	1565.1566	1414.8460	1175.4679	905.3916	602.9107	390.6559	410.9350	650.3845	988.9514	1322.9681	1606.8538	(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	802.3637	644.4556	558.0358	332.5820	150.8953	0.0000	0.0000	0.0000	0.0000	322.7103	576.9485	813.7828	(98)
Space heating												4201.7740	(98)
Space heating per m2												39.2836	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4498.6874 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	802.3637	644.4556	558.0358	332.5820	150.8953	0.0000	0.0000	0.0000	0.0000	322.7103	576.9485	813.7828	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	859.0617	689.9953	597.4687	356.0836	161.5582	0.0000	0.0000	0.0000	0.0000	345.5143	617.7178	871.2878	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	215.0453	189.5384	199.0494	177.7219	172.0662	151.5463	145.1929	161.8560	163.6436	185.0159	195.6487	209.8678	(64)
Efficiency of water heater (217)m	88.0589	87.8877	87.5062	86.6063	84.7226	80.3000	80.3000	80.3000	80.3000	86.4382	87.6095	80.3000	(216)
Fuel for water heating, kWh/month	244.2061	215.6597	227.4688	205.2068	203.0936	188.7251	180.8130	201.5642	203.7902	214.0441	223.3191	238.1412	(219)
Water heating fuel used												2546.0318	(219)
Annual totals kWh/year													
Space heating fuel - main system												4498.6874	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												469.2048	(232)
Total delivered energy for all uses												7588.9240	(238)

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	4498.6874	0.2160	971.7165 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2546.0318	0.2160	549.9429 (264)
Space and water heating			1521.6594 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	469.2048	0.5190	243.5173 (268)
Total CO2, kg/m2/year			1804.1016 (272)
Emissions per m2 for space and water heating			14.2264 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2767 (272b)
Emissions per m2 for pumps and fans			0.3639 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2264 * 1.00) + 2.2767 + 0.3639, rounded to 2 d.p.			16.8700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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					4 * 10 = 40.0000 (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) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.3900
Infiltration rate					0.4224 (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) =		0.3907 (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												
Effective ac	0.4982	0.4884	0.4786	0.4298	0.4200	0.3712	0.3712	0.3614	0.3907	0.4200	0.4395	0.4591 (22b)
	0.6241	0.6193	0.6145	0.5924	0.5882	0.5689	0.5689	0.5653	0.5763	0.5882	0.5966	0.6054 (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
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			12.5400	1.3258	16.6250		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	13.3300	92.1300	0.2000	18.4260	9.0000	829.1700 (29a)
Vertical Studwork	16.9200	1.3700	15.5500	0.1600	2.4880	9.0000	139.9500 (29a)
External Roof	23.9300		23.9300	0.1000	2.3930	9.0000	215.3700 (30)
Dormer Roof	2.4400		2.4400	0.1800	0.4392	9.0000	21.9600 (30)
Skellings	17.4500		17.4500	0.1600	2.7920	9.0000	157.0500 (30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.7680		(33)
Party Wall			53.4400	0.0000	0.0000	20.0000	1068.8000 (32)
Internal Wall - GF			47.4200			9.0000	426.7800 (32c)
Internal Wall - FF			64.2000			9.0000	577.8000 (32c)
Internal Wall - TF			23.5600			9.0000	212.0400 (32c)
Internal Floor			41.1300			18.0000	740.3400 (32d)
Internal Floor			24.7000			18.0000	444.6000 (32d)
Internal Ceiling			41.1300			9.0000	370.1700 (32e)
Internal Ceiling			24.7000			9.0000	222.3000 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			8511.0800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.5726 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4456 (36)
Total fabric heat loss						(33) + (36) =	68.2136 (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	53.8822	53.4662	53.0584	51.1432	50.7849	49.1168	49.1168	48.8079	49.7593	50.7849	51.5098	52.2676 (38)
Average = Sum(39)m / 12 =	122.0957	121.6797	121.2720	119.3568	118.9985	117.3304	117.3304	117.0215	117.9729	118.9985	119.7234	120.4812 (39)
												119.3551 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1415	1.1376	1.1338	1.1159	1.1126	1.0970	1.0970	1.0941	1.1030	1.1126	1.1193	1.1264 (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	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy conte	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Energy content (annual)	Total = Sum(45)m =											1582.6444 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
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)
Heat gains from water heating, kWh/month	34.8684	30.4961	31.4692	27.4356	26.3251	22.7166	21.0503	24.1555	24.4440	28.4871	31.0959	33.7681 (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	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5683	23.5977	19.1910	14.5288	10.8604	9.1688	9.9073	12.8778	17.2846	21.9468	25.6151	27.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765 (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)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)	46.8661	45.3811	42.2973	38.1050	35.3833	31.5508	28.2934	32.4671	33.9500	38.2891	43.1888	45.3873 (72)
Total internal gains	405.4776	403.7938	389.3185	365.5941	340.4333	317.2675	302.9627	307.3352	320.2097	344.0810	371.4196	392.9514 (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				4.6400	36.7938	0.6300	0.7000	0.7700	52.1753 (77)			
Southwest				1.2000	36.7938	0.6300	0.7000	0.7700	13.4936 (79)			
Northwest				6.7000	11.2829	0.6300	0.7000	0.7700	23.1030 (81)			
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660 (83)
Total gains	494.2495	562.6791	627.0955	694.3768	739.8819	727.5446	692.8052	642.3606	589.1718	525.1789	479.1454	468.0174 (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	19.3634	19.4296	19.4949	19.8077	19.8674	20.1498	20.1498	20.2030	20.0401	19.8674	19.7471	19.6229
alpha	2.2909	2.2953	2.2997	2.3205	2.3245	2.3433	2.3433	2.3469	2.3360	2.3245	2.3165	2.3082
util living area	0.9702	0.9586	0.9379	0.8959	0.8238	0.7119	0.5929	0.6372	0.8033	0.9167	0.9595	0.9736 (86)
MIT	18.0203	18.2833	18.7570	19.4131	20.0390	20.5468	20.7948	20.7488	20.3388	19.5384	18.6783	17.9851 (87)
Th 2	19.9671	19.9702	19.9733	19.9879	19.9906	20.0033	20.0033	20.0057	19.9984	19.9906	19.9851	19.9793 (88)
util rest of house	0.9662	0.9530	0.9289	0.8794	0.7920	0.6514	0.4966	0.5455	0.7561	0.9003	0.9531	0.9701 (89)
MIT 2	17.2245	17.4872	17.9581	18.6120	19.2163	19.6919	19.8958	19.8664	19.5125	18.7445	17.8917	17.1976 (90)
Living area fraction	17.3354	17.5981	18.0694	18.7236	19.3309	19.8110	20.0211	19.9893	fLA = Living area / (4) =	19.6276	18.8551	18.0013
MIT	17.3354	17.5981	18.0694	18.7236	19.3309	19.8110	20.0211	19.9893	19.6276	18.8551	18.0013	17.3073 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3354	17.5981	18.0694	18.7236	19.3309	19.8110	20.0211	19.9893	19.6276	18.8551	18.0013	17.3073 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9517	0.9351	0.9067	0.8533	0.7670	0.6380	0.4985	0.5438	0.7349	0.8760	0.9356	0.9567 (94)
Ext temp.	470.3541	526.1609	568.5626	592.5369	567.5162	464.1428	345.3700	349.3296	432.9854	460.0459	448.2692	447.7719 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1591.5657	1545.1023	1403.0454	1172.5135	908.0644	611.4122	401.3935	420.0298	652.1116	982.3451	1305.1347	1579.1884 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	834.1814	684.7286	620.8552	417.5831	253.3678	0.0000	0.0000	0.0000	0.0000	388.5906	616.9431	841.7738 (98)
Space heating per m2	(98) / (4) = 43.5492 (99)											

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

 Calculated for June, July and August. See Table 10b

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1102.9058	868.2450	889.3635	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6511	0.7200	0.6897	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	718.0736	625.1066	613.3981	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	960.3390	917.4522	860.8434	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	174.4311	217.5051	184.0994	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													576.0356 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	43.6078	54.3763	46.0248	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													144.0089 (107)
Space cooling per m2													1.3464 (108)
Energy for space heating													43.5492 (99)
Energy for space cooling													1.3464 (108)
Total													44.8956 (109)
Dwelling Fabric Energy Efficiency (DFEE)													44.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (Version 9.92, January 2014)
CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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					4 * 10 = 40.0000 (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) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4029 (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) =		0.3727 (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	0.4752	0.4658	0.4565	0.4099	0.4006	0.3540	0.3540	0.3447	0.3727	0.4006	0.4193	0.4379 (22b)
Effective ac	0.6129	0.6085	0.6042	0.5840	0.5802	0.5627	0.5627	0.5594	0.5694	0.5802	0.5879	0.5959 (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
TER Opaque door			2.1600	1.0000	2.1600		(26)
TER Opening Type (Uw = 1.40)			12.5400	1.3258	16.6250		(27)
Heat Loss Floor			41.1300	0.1300	5.3469		(28a)
External Wall	105.4600	13.3300	92.1300	0.1800	16.5834		(29a)
Vertical Studwork	16.9200	1.3700	15.5500	0.1800	2.7990		(29a)
External Roof	23.9300		23.9300	0.1300	3.1109		(30)
Dormer Roof	2.4400		2.4400	0.1300	0.3172		(30)
Skellings	17.4500		17.4500	0.1300	2.2685		(30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	49.2109		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9894 (36)
Total fabric heat loss						(33) + (36) =	60.2003 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	52.9159	52.5374	52.1664	50.4240	50.0980	48.5804	48.5804	48.2993	49.1649	50.0980	50.7575	51.4470 (38)
Heat transfer coeff	113.1162	112.7377	112.3667	110.6243	110.2983	108.7807	108.7807	108.4996	109.3652	110.2983	110.9578	111.6473 (39)
Average = Sum(39)m / 12 =												110.6227 (39)
HLP	1.0576	1.0540	1.0505	1.0343	1.0312	1.0170	1.0170	1.0144	1.0225	1.0312	1.0374	1.0438 (40)
HLP (average)												1.0342 (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												2.7953 (42)
Average daily hot water use (litres/day)												100.5882 (43)
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy conte	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Energy content (annual)										Total = Sum(45)m =		1582.6444 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
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)
Heat gains from water heating, kWh/month	34.8684	30.4961	31.4692	27.4356	26.3251	22.7166	21.0503	24.1555	24.4440	28.4871	31.0959	33.7681	(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	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5683	23.5977	19.1910	14.5288	10.8604	9.1688	9.9073	12.8778	17.2846	21.9468	25.6151	27.3067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(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)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)	46.8661	45.3811	42.2973	38.1050	35.3833	31.5508	28.2934	32.4671	33.9500	38.2891	43.1888	45.3873	(72)
Total internal gains	405.4776	403.7938	389.3185	365.5941	340.4333	317.2675	302.9627	307.3352	320.2097	344.0810	371.4196	392.9514	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Southeast	4.6400	36.7938	0.6300		0.7000	0.7700	52.1753 (77)
Southwest	1.2000	36.7938	0.6300		0.7000	0.7700	13.4936 (79)
Northwest	6.7000	11.2829	0.6300		0.7000	0.7700	23.1030 (81)

Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660	(83)
Total gains	494.2495	562.6791	627.0955	694.3768	739.8819	727.5446	692.8052	642.3606	589.1718	525.1789	479.1454	468.0174	(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	65.6651	65.8855	66.1030	67.1442	67.3426	68.2821	68.2821	68.4590	67.9172	67.3426	66.9424	66.5290	
alpha	5.3777	5.3924	5.4069	5.4763	5.4895	5.5521	5.5521	5.5639	5.5278	5.4895	5.4628	5.4353	
util living area	0.9995	0.9988	0.9965	0.9866	0.9473	0.8281	0.6608	0.7244	0.9303	0.9925	0.9988	0.9996	(86)
MIT	19.7541	19.8801	20.1018	20.4138	20.7084	20.9157	20.9813	20.9696	20.8144	20.4383	20.0464	19.7395	(87)
Th 2	20.0356	20.0386	20.0414	20.0549	20.0574	20.0692	20.0692	20.0714	20.0646	20.0574	20.0523	20.0470	(88)
util rest of house	0.9993	0.9983	0.9951	0.9808	0.9223	0.7512	0.5360	0.6029	0.8864	0.9884	0.9983	0.9995	(89)
MIT 2	18.8871	19.0153	19.2388	19.5589	19.8425	20.0256	20.0638	20.0614	19.9477	19.5871	19.1928	18.8817	(90)
Living area fraction									fLA = Living area / (4) =				0.1393 (91)
MIT	19.0079	19.1358	19.3590	19.6780	19.9632	20.1496	20.1916	20.1879	20.0685	19.7057	19.3117	19.0012	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0079	19.1358	19.3590	19.6780	19.9632	20.1496	20.1916	20.1879	20.0685	19.7057	19.3117	19.0012	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	493.7410	561.3946	623.1856	678.8928	680.1025	552.0049	383.4423	397.9530	522.3977	517.9392	478.0856	467.6643	(94)
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	1663.6960	1604.9128	1444.9225	1192.3072	911.4131	603.6866	390.6944	410.9854	652.7411	1004.3390	1354.9843	1652.5081	(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	870.4465	701.2443	611.3723	369.6584	172.0951	0.0000	0.0000	0.0000	0.0000	361.8815	631.3670	881.5238	(98)
Space heating												4599.5888	(98)
Space heating per m ²												43.0029	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1022.5383	804.9769	824.5972	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8196	0.8970	0.8653	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	838.0478	722.0261	713.5019	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	960.3390	917.4522	860.8434	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	88.0497	145.3970	109.6221	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												343.0688 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling												0.0000 (107)
Space cooling per m2												85.7672 (107)
Energy for space heating												0.8019 (108)
Energy for space cooling												43.0029 (99)
Total												0.8019 (108)
Target Fabric Energy Efficiency (TFEE)												43.8047 (109)
												50.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (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					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.3900
Infiltration rate					0.4224 (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) = 0.3907 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.4298	0.4005	0.4005	0.3809	0.3809	0.3614	0.3614	0.3419	0.3419	0.3712	0.3614	0.3809 (22b)
Effective ac	0.5924	0.5802	0.5802	0.5726	0.5726	0.5653	0.5653	0.5584	0.5584	0.5689	0.5653	0.5726 (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
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			12.5400	1.3258	16.6250		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	13.3300	92.1300	0.2000	18.4260	9.0000	829.1700 (29a)
Vertical Studwork	16.9200	1.3700	15.5500	0.1600	2.4880	9.0000	139.9500 (29a)
External Roof	23.9300		23.9300	0.1000	2.3930	9.0000	215.3700 (30)
Dormer Roof	2.4400		2.4400	0.1800	0.4392	9.0000	21.9600 (30)
Skellings	17.4500		17.4500	0.1600	2.7920	9.0000	157.0500 (30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.7680		(33)
Party Wall			53.4400	0.0000	0.0000	20.0000	1068.8000 (32)
Internal Wall - GF			47.4200			9.0000	426.7800 (32c)
Internal Wall - FF			64.2000			9.0000	577.8000 (32c)
Internal Wall - TF			23.5600			9.0000	212.0400 (32c)
Internal Floor			41.1300			18.0000	740.3400 (32d)
Internal Floor			24.7000			18.0000	444.6000 (32d)
Internal Ceiling			41.1300			18.0000	740.3400 (32e)
Internal Ceiling			24.7000			18.0000	444.6000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 9103.5500 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							85.1117 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4456 (36)
Total fabric heat loss							(33) + (36) = 68.2136 (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	51.1432	50.0930	50.0930	49.4340	49.4340	48.8079	48.8079	48.2148	48.2148	49.1168	48.8079	49.4340 (38)
Average = Sum(39)m / 12 =	119.3568	118.3065	118.3065	117.6475	117.6475	117.0215	117.0215	116.4284	116.4284	117.3304	117.0215	117.6475 (39)
												117.5137 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1159	1.1061	1.1061	1.0999	1.0999	1.0941	1.0941	1.0885	1.0885	1.0970	1.0941	1.0999 (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	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Average daily hot water use (litres/day)												100.5882 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Distribution loss (46)m = 0.15 x (45)m	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Water storage loss:	Total = Sum(45)m =											1582.6444 (45)
Total storage loss	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Solar input	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
RHI water heating demand	Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Heat gains from water heating, kWh/month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (64)
	Total per year (kWh/year) = Sum(64)m =											1748.3289 (64)
												1748 (64)
	58.0963	50.9098	52.7681	46.3333	44.7005	38.9311	36.4304	41.2999	41.6439	48.0935	52.0719	56.3717 (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	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4208	58.9944	47.9774	36.3220	27.1511	22.9221	24.7682	32.1946	43.2115	54.8669	64.0378	68.2668 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.6773	402.8143	392.3892	370.1952	342.1794	315.8484	298.2577	294.1207	304.5458	326.7398	354.7556	381.0866 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)	78.0864	75.7587	70.9248	64.3518	60.0814	54.0709	48.9656	55.5106	57.8387	64.6418	72.3221	75.7684 (72)
Total internal gains	656.6575	651.0403	624.7644	584.3419	542.8848	506.3144	485.4644	495.2988	519.0690	559.7215	604.5885	638.5948 (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				4.6400	45.1778	0.6300	0.7000	0.7700	64.0642 (77)			
Southwest				1.2000	45.1778	0.6300	0.7000	0.7700	16.5683 (79)			
Northwest				6.7000	14.6176	0.6300	0.7000	0.7700	29.9312 (81)			
Solar gains	110.5637	169.0605	256.7226	359.5289	414.4633	467.1286	428.0937	383.0805	305.3071	205.7465	133.8670	88.4224 (83)
Total gains	767.2211	820.1007	881.4869	943.8708	957.3480	973.4430	913.5581	878.3792	824.3761	765.4679	738.4555	727.0171 (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	21.1866	21.3747	21.3747	21.4944	21.4944	21.6094	21.6094	21.7195	21.7195	21.5525	21.6094	21.4944
alpha	2.4124	2.4250	2.4250	2.4330	2.4330	2.4406	2.4406	2.4480	2.4480	2.4368	2.4406	2.4330
util living area	0.9272	0.9120	0.8765	0.8102	0.6981	0.5248	0.3912	0.4029	0.6297	0.8123	0.8983	0.9330 (86)
MIT	18.8614	19.0624	19.4837	20.0098	20.5118	20.8389	20.9461	20.9431	20.7286	20.1870	19.4795	18.8581 (87)
Th 2	19.9879	19.9959	19.9959	20.0009	20.0009	20.0057	20.0057	20.0102	20.0102	20.0033	20.0057	20.0009 (88)
util rest of house	0.9175	0.9003	0.8593	0.7820	0.6483	0.4446	0.2846	0.2943	0.5565	0.7774	0.8824	0.9239 (89)
MIT 2	18.0599	18.2620	18.6729	19.1808	19.6433	19.9164	19.9872	19.9905	19.8417	19.3593	18.6813	18.0665 (90)
Living area fraction									fLa = Living area / (4) =			0.1393 (91)
MIT	18.1716	18.3735	18.7859	19.2963	19.7643	20.0449	20.1208	20.1232	19.9653	19.4746	18.7925	18.1767 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1716	18.3735	18.7859	19.2963	19.7643	20.0449	20.1208	20.1232	19.9653	19.4746	18.7925	18.1767 (93)

8. Space heating requirement

Utilisation	0.8951	0.8766	0.8341	0.7589	0.6352	0.4480	0.2976	0.3074	0.5528	0.7555	0.8583	0.9025 (94)
Useful gains	686.7666	718.9052	735.2398	716.2632	608.0807	436.1431	271.8656	270.0121	455.6876	578.3197	633.8098	656.1278 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1524.3731	1475.6974	1323.3595	1093.6873	784.0392	485.0457	283.2875	282.1329	543.1716	876.9928	1216.1494	1491.3865 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	623.1793	508.5644	437.5610	271.7453	130.9131	0.0000	0.0000	0.0000	0.0000	222.2127	419.2845	621.4325 (98)
Space heating												3234.8928 (98)
RHI space heating demand												3235 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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					4 * 10 = 40.0000 (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) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.3900
Infiltration rate					0.4224 (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) =		0.3907 (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	0.4982	0.4884	0.4786	0.4298	0.4200	0.3712	0.3712	0.3614	0.3907	0.4200	0.4395	0.4591 (22b)
Effective ac	0.6241	0.6193	0.6145	0.5924	0.5882	0.5689	0.5689	0.5653	0.5763	0.5882	0.5966	0.6054 (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
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			12.5400	1.3258	16.6250		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	13.3300	92.1300	0.2000	18.4260	9.0000	829.1700 (29a)
Vertical Studwork	16.9200	1.3700	15.5500	0.1600	2.4880	9.0000	139.9500 (29a)
External Roof	23.9300		23.9300	0.1000	2.3930	9.0000	215.3700 (30)
Dormer Roof	2.4400		2.4400	0.1800	0.4392	9.0000	21.9600 (30)
Skellings	17.4500		17.4500	0.1600	2.7920	9.0000	157.0500 (30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.7680		(33)
Party Wall			53.4400	0.0000	0.0000	20.0000	1068.8000 (32)
Internal Wall - GF			47.4200			9.0000	426.7800 (32c)
Internal Wall - FF			64.2000			9.0000	577.8000 (32c)
Internal Wall - TF			23.5600			9.0000	212.0400 (32c)
Internal Floor			41.1300			18.0000	740.3400 (32d)
Internal Floor			24.7000			18.0000	444.6000 (32d)
Internal Ceiling			41.1300			18.0000	740.3400 (32e)
Internal Ceiling			24.7000			18.0000	444.6000 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9103.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.1117 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4456 (36)
Total fabric heat loss						(33) + (36) =	68.2136 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	53.8822	53.4662	53.0584	51.1432	50.7849	49.1168	49.1168	48.8079	49.7593	50.7849	51.5098	52.2676 (38)
Heat transfer coeff	122.0957	121.6797	121.2720	119.3568	118.9985	117.3304	117.3304	117.0215	117.9729	118.9985	119.7234	120.4812 (39)
Average = Sum(39)m / 12 =												119.3551 (39)
HLP	1.1415	1.1376	1.1338	1.1159	1.1126	1.0970	1.0970	1.0941	1.1030	1.1126	1.1193	1.1264 (40)
HLP (average)												1.1159 (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	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy content (annual)	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1582.6444 (45)
	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (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	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (64)
								Total per year (kWh/year) = Sum (64)m =				1748.3289 (64)
Heat gains from water heating, kWh/month	58.0963	50.9098	52.7681	46.3333	44.7005	38.9311	36.4304	41.2999	41.6439	48.0935	52.0719	56.3717 (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	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4208	58.9944	47.9774	36.3220	27.1511	22.9221	24.7682	32.1946	43.2115	54.8669	64.0378	68.2668 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.6773	402.8143	392.3892	370.1952	342.1794	315.8484	298.2577	294.1207	304.5458	326.7398	354.7556	381.0866 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)	78.0864	75.7587	70.9248	64.3518	60.0814	54.0709	48.9656	55.5106	57.8387	64.6418	72.3221	75.7684 (72)
Total internal gains	656.6575	651.0403	624.7644	584.3419	542.8848	506.3144	485.4644	495.2988	519.0690	559.7215	604.5885	638.5948 (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				4.6400	36.7938	0.6300	0.7000	0.7700			52.1753 (77)	
Southwest				1.2000	36.7938	0.6300	0.7000	0.7700			13.4936 (79)	
Northwest				6.7000	11.2829	0.6300	0.7000	0.7700			23.1030 (81)	
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660 (83)
Total gains	745.4294	809.9256	862.5414	913.1246	942.3334	916.5915	875.3069	830.3242	788.0311	740.8194	712.3143	713.6607 (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	20.7113	20.7821	20.8520	21.1866	21.2504	21.5525	21.5525	21.6094	21.4351	21.2504	21.1217	20.9889
alpha	2.3808	2.3855	2.3901	2.4124	2.4167	2.4368	2.4368	2.4406	2.4290	2.4167	2.4081	2.3993
util living area	0.9402	0.9249	0.8980	0.8461	0.7617	0.6356	0.5100	0.5461	0.7198	0.8595	0.9215	0.9453 (86)
MIT	18.5370	18.7697	19.1838	19.7517	20.2763	20.6848	20.8692	20.8410	20.5389	19.8818	19.1293	18.5019 (87)
Th 2	19.9671	19.9702	19.9733	19.9879	19.9906	20.0033	20.0033	20.0057	19.9984	19.9906	19.9851	19.9793 (88)
util rest of house	0.9255	0.9152	0.8842	0.8236	0.7234	0.5708	0.4169	0.4551	0.6631	0.8346	0.9098	0.9383 (89)
MIT 2	17.7256	17.9564	18.3649	18.9259	19.4231	19.7508	19.9389	19.9231	19.6747	19.0615	18.3245	17.6995 (90)
Living area fraction									fLA = Living area / (4) =			0.1393 (91)
MIT	17.8387	18.0697	18.4790	19.0410	19.5419	19.9197	20.0685	20.0510	19.7951	19.1758	18.4366	17.8113 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8387	18.0697	18.4790	19.0410	19.5419	19.9197	20.0685	20.0510	19.7951	19.1758	18.4366	17.8113 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9116	0.8922	0.8591	0.7986	0.7039	0.5648	0.4235	0.4596	0.6500	0.8100	0.8868	0.9184 (94)
Useful gains	679.5063	722.5993	740.9819	729.1935	663.2698	517.6549	370.6647	381.6292	512.2582	600.0792	631.6957	655.4571 (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	1653.0144	1602.4835	1452.7159	1210.3924	933.1789	624.1571	406.9616	427.2404	671.8699	1020.5045	1357.2554	1639.9029 (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	724.2900	591.2822	529.5301	346.4632	200.8124	0.0000	0.0000	0.0000	0.0000	312.7964	522.4030	732.4277 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating
Space heating per m2

(98) / (4) = 3960.0049 (98)
37.0232 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4375.6961 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	724.2900	591.2822	529.5301	346.4632	200.8124	0.0000	0.0000	0.0000	0.0000	312.7964	522.4030	732.4277	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	800.3204	653.3505	585.1162	382.8323	221.8922	0.0000	0.0000	0.0000	0.0000	345.6313	577.2408	809.3123	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468	(64)
Efficiency of water heater (217)m	89.8496	89.8118	89.7288	89.5424	89.1692	87.3000	87.3000	87.3000	87.3000	89.4463	89.7288	87.3000	(216)
Fuel for water heating, kWh/month	198.3723	174.0091	180.7697	159.3962	154.6731	137.9687	129.4752	146.2628	147.3258	165.6136	178.3124	192.5514	(219)
Water heating fuel used												1964.7306	(219)
Annual totals kWh/year													
Space heating fuel - main system												4375.6961	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												469.2048	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.28 * 677 * 1.00) =										-692.7410		-692.7410	(233)
Total delivered energy for all uses												6191.8904	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4375.6961	3.4800	152.2742 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1964.7306	3.4800	68.3726 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	469.2048	13.1900	61.8881 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-692.7410	13.1900	-91.3725 (252)
Total energy cost			321.0549 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.8874 (257)
SAP value		87.6213
SAP rating (Section 12)		88 (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	4375.6961	0.2160	945.1503 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.7306	0.2160	424.3818 (264)
Space and water heating			1369.5321 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	469.2048	0.5190	243.5173 (268)
Energy saving/generation technologies			
PV Unit	-692.7410	0.5190	-359.5326 (269)
Total kg/year			1292.4419 (272)
CO2 emissions per m2			12.0800 (273)
EI value			88.6031
EI rating			89 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8886 = 3.916$, stars = 4
Water heating environmental impact	$0.216 / 0.8886 = 0.2431$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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					4 * 10 = 40.0000 (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) =				40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.3900
Infiltration rate					0.4224 (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) =				0.3907 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.4298	0.4005	0.4005	0.3809	0.3809	0.3614	0.3614	0.3419	0.3419	0.3712	0.3614	0.3809 (22b)
Effective ac	0.5924	0.5802	0.5802	0.5726	0.5726	0.5653	0.5653	0.5584	0.5584	0.5689	0.5653	0.5726 (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
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			12.5400	1.3258	16.6250		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	13.3300	92.1300	0.2000	18.4260	9.0000	829.1700 (29a)
Vertical Studwork	16.9200	1.3700	15.5500	0.1600	2.4880	9.0000	139.9500 (29a)
External Roof	23.9300		23.9300	0.1000	2.3930	9.0000	215.3700 (30)
Dormer Roof	2.4400		2.4400	0.1800	0.4392	9.0000	21.9600 (30)
Skellings	17.4500		17.4500	0.1600	2.7920	9.0000	157.0500 (30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.7680		(33)
Party Wall			53.4400	0.0000	0.0000	20.0000	1068.8000 (32)
Internal Wall - GF			47.4200			9.0000	426.7800 (32c)
Internal Wall - FF			64.2000			9.0000	577.8000 (32c)
Internal Wall - TF			23.5600			9.0000	212.0400 (32c)
Internal Floor			41.1300			18.0000	740.3400 (32d)
Internal Floor			24.7000			18.0000	444.6000 (32d)
Internal Ceiling			41.1300			18.0000	740.3400 (32e)
Internal Ceiling			24.7000			18.0000	444.6000 (32e)
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			9103.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.1117 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4456 (36)
Total fabric heat loss						(33) + (36) =	68.2136 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	51.1432	50.0930	50.0930	49.4340	49.4340	48.8079	48.8079	48.2148	48.2148	49.1168	48.8079	49.4340 (38)
Heat transfer coeff	119.3568	118.3065	118.3065	117.6475	117.6475	117.0215	117.0215	116.4284	116.4284	117.3304	117.0215	117.6475 (39)
Average = Sum(39)m / 12 =												117.5137 (39)
HLP	1.1159	1.1061	1.1061	1.0999	1.0999	1.0941	1.0941	1.0885	1.0885	1.0970	1.0941	1.0999 (40)
HLP (average)												1.0987 (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	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Average daily hot water use (litres/day)												100.5882 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Distribution loss (46)m = 0.15 x (45)m	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Total storage loss	Total = Sum (45)m =											1582.6444 (45)
Water storage loss:	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (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	Solar input (sum of months) = Sum (63)m =											0.0000 (63)
Heat gains from water heating, kWh/month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (64)
	Total per year (kWh/year) = Sum (64)m =											1748.3289 (64)
	58.0963	50.9098	52.7681	46.3333	44.7005	38.9311	36.4304	41.2999	41.6439	48.0935	52.0719	56.3717 (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	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4208	58.9944	47.9774	36.3220	27.1511	22.9221	24.7682	32.1946	43.2115	54.8669	64.0378	68.2668 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.6773	402.8143	392.3892	370.1952	342.1794	315.8484	298.2577	294.1207	304.5458	326.7398	354.7556	381.0866 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)	78.0864	75.7587	70.9248	64.3518	60.0814	54.0709	48.9656	55.5106	57.8387	64.6418	72.3221	75.7684 (72)
Total internal gains	656.6575	651.0403	624.7644	584.3419	542.8848	506.3144	485.4644	495.2988	519.0690	559.7215	604.5885	638.5948 (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					4.6400	45.1778	0.6300	0.7000			0.7700			64.0642 (77)
Southwest					1.2000	45.1778	0.6300	0.7000			0.7700			16.5683 (79)
Northwest					6.7000	14.6176	0.6300	0.7000			0.7700			29.9312 (81)
Solar gains	110.5637	169.0605	256.7226	359.5289	414.4633	467.1286	428.0937	383.0805	305.3071	205.7465	133.8670			88.4224 (83)
Total gains	767.2211	820.1007	881.4869	943.8708	957.3480	973.4430	913.5581	878.3792	824.3761	765.4679	738.4555			727.0171 (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	21.1866	21.3747	21.3747	21.4944	21.4944	21.6094	21.6094	21.7195	21.7195	21.5525	21.6094	21.4944
alpha	2.4124	2.4250	2.4250	2.4330	2.4330	2.4406	2.4406	2.4480	2.4480	2.4368	2.4406	2.4330
util living area	0.9272	0.9120	0.8765	0.8102	0.6981	0.5248	0.3912	0.4029	0.6297	0.8123	0.8983	0.9330 (86)
MIT	18.8614	19.0624	19.4837	20.0098	20.5118	20.8389	20.9461	20.9431	20.7286	20.1870	19.4795	18.8581 (87)
Th 2	19.9879	19.9959	19.9959	20.0009	20.0009	20.0057	20.0057	20.0102	20.0102	20.0033	20.0057	20.0009 (88)
util rest of house	0.9175	0.9003	0.8593	0.7820	0.6483	0.4446	0.2846	0.2943	0.5565	0.7774	0.8824	0.9239 (89)
MIT 2	18.0599	18.2620	18.6729	19.1808	19.6433	19.9164	19.9872	19.9905	19.8417	19.3593	18.6813	18.0665 (90)
Living area fraction									fLa = Living area / (4) =			0.1393 (91)
MIT	18.1716	18.3735	18.7859	19.2963	19.7643	20.0449	20.1208	20.1232	19.9653	19.4746	18.7925	18.1767 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1716	18.3735	18.7859	19.2963	19.7643	20.0449	20.1208	20.1232	19.9653	19.4746	18.7925	18.1767 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8951	0.8766	0.8341	0.7589	0.6352	0.4480	0.2976	0.3074	0.5528	0.7555	0.8583	0.9025 (94)
Ext temp.	686.7666	718.9052	735.2398	716.2632	608.0807	436.1431	271.8656	270.0121	455.6876	578.3197	633.8098	656.1278 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	1524.3731	1475.6974	1323.3595	1093.6873	784.0392	485.0457	283.2875	282.1329	543.1716	876.9928	1216.1494	1491.3865 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	623.1793	508.5644	437.5610	271.7453	130.9131	0.0000	0.0000	0.0000	0.0000	222.2127	419.2845	621.4325 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating
Space heating per m2 (98) / (4) = 3234.8928 (98)
30.2439 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 90.5000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3574.4671 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	623.1793	508.5644	437.5610	271.7453	130.9131	0.0000	0.0000	0.0000	0.0000	222.2127	419.2845	621.4325 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	688.5959	561.9496	483.4929	300.2710	144.6553	0.0000	0.0000	0.0000	0.0000	245.5389	463.2978	686.6657 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (64)
Efficiency of water heater (217)m	89.7682	89.7269	89.6117	89.3719	88.8295	87.3000	87.3000	87.3000	87.3000	89.1923	89.5929	87.3000 (216)
Fuel for water heating, kWh/month	198.5522	174.1738	181.0060	159.7002	155.2645	137.9687	129.4752	146.2628	147.3258	166.0853	178.5829	192.7386 (219)
Water heating fuel used												1967.1360 (219)
Annual totals kWh/year												
Space heating fuel - main system												3574.4671 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												469.2048 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.28 * 776 * 1.00) =									-794.4149			-794.4149 (233)
Total delivered energy for all uses												5291.3930 (238)

10a. Fuel costs - using BEDF prices (511)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3574.4671	4.2600	152.2723 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1967.1360	4.2600	83.8000 (247)
Pumps and fans for heating	75.0000	22.5500	16.9125 (249)
Energy for lighting	469.2048	22.5500	105.8057 (250)
Additional standing charges			96.0000 (251)
Energy saving/generation technologies			
PV Unit	-794.4149	22.5500	-179.1406 (252)
Total energy cost			275.6499 (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	3574.4671	0.2160	772.0849 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1967.1360	0.2160	424.9014 (264)
Space and water heating			1196.9863 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	469.2048	0.5190	243.5173 (268)
Energy saving/generation technologies			
PV Unit	-794.4149	0.5190	-412.3013 (269)
Total kg/year			1067.1272 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3574.4671	1.2200	4360.8499 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1967.1360	1.2200	2399.9059 (264)
Space and water heating			6760.7558 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	469.2048	3.0700	1440.4587 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-794.4149	3.0700	-2438.8536 (269)
Primary energy kWh/year			5992.6108 (272)
Primary energy kWh/m ² /year			56.0267 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
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	+ 1.1	-£ 32	-194 kg (18.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 1.82 kg/m ²	B 89	B 90
Total Savings	£32 1.82 kg/m ²		

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

Fuel prices for cost data on this page from database revision number 511 TEST (31 Jan 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£123	£134	-£11
Mains gas	£332	£289	£43
Space heating	£265	£265	£0
Water heating	£84	£52	£32
Lighting	£106	£106	£0
Generated (PV)	-£179	-£179	£0
Total cost of fuels	£276	£244	£32
Total cost of uses	£276	£244	£32
Delivered energy	49 kWh/m ²	40 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	56 kWh/m ²	46 kWh/m ²	10 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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					4 * 10 = 40.0000 (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) =				Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.3900
Infiltration rate					0.4224 (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) =				0.3907 (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	0.4982	0.4884	0.4786	0.4298	0.4200	0.3712	0.3712	0.3614	0.3907	0.4200	0.4395	0.4591 (22b)
Effective ac	0.6241	0.6193	0.6145	0.5924	0.5882	0.5689	0.5689	0.5653	0.5763	0.5882	0.5966	0.6054 (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
Solid Doors			2.1600	1.4000	3.0240		(26)
Windows (Uw = 1.40)			12.5400	1.3258	16.6250		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	13.3300	92.1300	0.2000	18.4260	9.0000	829.1700 (29a)
Vertical Studwork		1.3700	15.5500	0.1600	2.4880	9.0000	139.9500 (29a)
External Roof	23.9300		23.9300	0.1000	2.3930	9.0000	215.3700 (30)
Dormer Roof	2.4400		2.4400	0.1800	0.4392	9.0000	21.9600 (30)
Skellings	17.4500		17.4500	0.1600	2.7920	9.0000	157.0500 (30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		52.7680		(33)
Party Wall			53.4400	0.0000	0.0000	20.0000	1068.8000 (32)
Internal Wall - GF			47.4200			9.0000	426.7800 (32c)
Internal Wall - FF			64.2000			9.0000	577.8000 (32c)
Internal Wall - TF			23.5600			9.0000	212.0400 (32c)
Internal Floor			41.1300			18.0000	740.3400 (32d)
Internal Floor			24.7000			18.0000	444.6000 (32d)
Internal Ceiling			41.1300			18.0000	740.3400 (32e)
Internal Ceiling			24.7000			18.0000	444.6000 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				9103.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.1117 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4456 (36)
Total fabric heat loss						(33) + (36) =	68.2136 (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	53.8822	53.4662	53.0584	51.1432	50.7849	49.1168	49.1168	48.8079	49.7593	50.7849	51.5098	52.2676 (38)
Heat transfer coeff	122.0957	121.6797	121.2720	119.3568	118.9985	117.3304	117.3304	117.0215	117.9729	118.9985	119.7234	120.4812 (39)
Average = Sum(39)m / 12 =												119.3551 (39)
HLP	1.1415	1.1376	1.1338	1.1159	1.1126	1.0970	1.0970	1.0941	1.1030	1.1126	1.1193	1.1264 (40)
HLP (average)												1.1159 (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	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy conte	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Energy content (annual)	Total = Sum(45)m =											1582.6444 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (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												1.1459 (H8)
Utilisation factor												0.5822 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.5882 (H14)
Volume ratio Veff/V												0.7456 (H15)
Solar storage volume factor												0.9413 (H16)
Solar input												-873.8574 (H17)
Solar input	-25.3401	-42.2854	-72.0168	-96.5168	-119.2383	-117.2303	-115.6810	-101.0711	-79.1589	-54.0562	-30.0570	-21.2054 (63)
	Solar input (sum of months) = Sum(63)m =											-873.8574 (63)
Output from w/h	152.8966	113.9953	90.1856	46.2104	18.6824	3.2164	0.0000	26.6163	49.4565	94.0790	129.9406	151.8415 (64)
	Total per year (kWh/year) = Sum(64)m =											877.1207 (64)
Heat gains from water heating, kWh/month	58.0963	50.9098	52.7681	46.3333	44.7005	38.9311	36.4304	41.2999	41.6439	48.0935	52.0719	56.3717 (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	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4208	58.9944	47.9774	36.3220	27.1511	22.9221	24.7682	32.1946	43.2115	54.8669	64.0378	68.2668 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.6773	402.8143	392.3892	370.1952	342.1794	315.8484	298.2577	294.1207	304.5458	326.7398	354.7556	381.0866 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)	78.0864	75.7587	70.9248	64.3518	60.0814	54.0709	48.9656	55.5106	57.8387	64.6418	72.3221	75.7684 (72)
Total internal gains	656.6575	651.0403	624.7644	584.3419	542.8848	506.3144	485.4644	495.2988	519.0690	559.7215	604.5885	638.5948 (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				4.6400	36.7938		0.6300		0.7000		0.7700		52.1753 (77)
Southwest				1.2000	36.7938		0.6300		0.7000		0.7700		13.4936 (79)
Northwest				6.7000	11.2829		0.6300		0.7000		0.7700		23.1030 (81)
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258		75.0660 (83)
Total gains	745.4294	809.9256	862.5414	913.1246	942.3334	916.5915	875.3069	830.3242	788.0311	740.8194	712.3143		713.6607 (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	20.7113	20.7821	20.8520	21.1866	21.2504	21.5525	21.5525	21.6094	21.4351	21.2504	21.1217	20.9889
alpha	2.3808	2.3855	2.3901	2.4124	2.4167	2.4368	2.4368	2.4406	2.4290	2.4167	2.4081	2.3993
util living area												
	0.9402	0.9249	0.8980	0.8461	0.7617	0.6356	0.5100	0.5461	0.7198	0.8595	0.9215	0.9453 (86)
MIT	18.5370	18.7697	19.1838	19.7517	20.2763	20.6848	20.8692	20.8410	20.5389	19.8818	19.1293	18.5019 (87)
Th 2	19.9671	19.9702	19.9733	19.9879	19.9906	20.0033	20.0033	20.0057	19.9984	19.9906	19.9851	19.9793 (88)
util rest of house												
	0.9325	0.9152	0.8842	0.8236	0.7234	0.5708	0.4169	0.4551	0.6631	0.8346	0.9098	0.9383 (89)
MIT 2	17.7256	17.9564	18.3649	18.9259	19.4231	19.7958	19.9389	19.9231	19.6747	19.0615	18.3245	17.6995 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											

MIT	17.8387	18.0697	18.4790	19.0410	19.5419	19.9197	20.0685	20.0510	19.7951	19.1758	18.4366	17.8113 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8387	18.0697	18.4790	19.0410	19.5419	19.9197	20.0685	20.0510	19.7951	19.1758	18.4366	17.8113 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4375.6961	0.2160	945.1503 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	978.0330	0.2160	211.2551 (264)
Space and water heating			1156.4055 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	469.2048	0.5190	243.5173 (268)
Energy saving/generation technologies			
PV Unit	-692.7410	0.5190	-359.5326 (269)
Total kg/year			1105.2652 (272)
CO2 emissions per m2			10.3300 (273)
EI value			90.2536
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	41.1300 (1b)	x 2.4000 (2b)	= 98.7120 (1b) - (3b)
First floor	41.1300 (1c)	x 2.7000 (2c)	= 111.0510 (1c) - (3c)
Second floor	24.7000 (1d)	x 2.1000 (2d)	= 51.8700 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	106.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 261.6330 (5)

2. Ventilation rate

	main		secondary		other		total	m3 per hour				
	heating		heating									
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							4 * 10 =	40.0000	(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) =						40.0000 / (5) =	0.1529 (8)				
Pressure test							Yes					
Measured/design AP50								5.3900				
Infiltration rate								0.4224 (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) =	0.3907 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.4298	0.4005	0.4005	0.3809	0.3809	0.3614	0.3614	0.3419	0.3419	0.3712	0.3614	0.3809 (22b)
Effective ac	0.5924	0.5802	0.5802	0.5726	0.5726	0.5653	0.5653	0.5584	0.5584	0.5689	0.5653	0.5726 (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					
Solid Doors			2.1600	1.4000	3.0240			(26)				
Windows (Uw = 1.40)			12.5400	1.3258	16.6250			(27)				
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500	(28a)				
External Wall	105.4600	13.3300	92.1300	0.2000	18.4260	9.0000	829.1700	(29a)				
Vertical Studwork	16.9200	1.3700	15.5500	0.1600	2.4880	9.0000	139.9500	(29a)				
External Roof	23.9300		23.9300	0.1000	2.3930	9.0000	215.3700	(30)				
Dormer Roof	2.4400		2.4400	0.1800	0.4392	9.0000	21.9600	(30)				
Skillings	17.4500		17.4500	0.1600	2.7920	9.0000	157.0500	(30)				
Total net area of external elements Aum(A, m2)			207.3300					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	52.7680			(33)				
Party Wall			53.4400	0.0000	0.0000	20.0000	1068.8000	(32)				
Internal Wall - GF			47.4200			9.0000	426.7800	(32c)				
Internal Wall - FF			64.2000			9.0000	577.8000	(32c)				
Internal Wall - TF			23.5600			9.0000	212.0400	(32c)				
Internal Floor			41.1300			18.0000	740.3400	(32d)				
Internal Floor			24.7000			18.0000	444.6000	(32d)				
Internal Ceiling			41.1300			18.0000	740.3400	(32e)				
Internal Ceiling			24.7000			18.0000	444.6000	(32e)				
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9103.5500	(34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							85.1117	(35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.4456	(36)				
Total fabric heat loss						(33) + (36) =	68.2136	(37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.1432	Feb 50.0930	Mar 50.0930	Apr 49.4340	May 49.4340	Jun 48.8079	Jul 48.8079	Aug 48.2148	Sep 48.2148	Oct 49.1168	Nov 48.8079	Dec 49.4340 (38)
Heat transfer coeff	119.3568	118.3065	118.3065	117.6475	117.6475	117.0215	117.0215	116.4284	116.4284	117.3304	117.0215	117.6475 (39)
Average = Sum(39)m / 12 =												117.5137 (39)
HLP	Jan 1.1159	Feb 1.1061	Mar 1.1061	Apr 1.0999	May 1.0999	Jun 1.0941	Jul 1.0941	Aug 1.0885	Sep 1.0885	Oct 1.0970	Nov 1.0941	Dec 1.0999 (40)
HLP (average)												1.0987 (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 2.7953 (42)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy conte	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Energy content (annual)	Total = Sum(45)m =											1582.6444 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (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												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2744 (H8)
Utilisation factor												0.5437 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.5882 (H14)
Volume ratio Veff/V												0.7456 (H15)
Solar storage volume factor												0.9413 (H16)
Solar input												-907.6949 (H17)
Solar input	-29.7976	-42.3703	-72.8244	-98.2570	-114.8374	-123.8154	-117.8626	-107.4241	-83.9413	-57.7271	-35.2427	-23.5948 (63)
Output from w/h	Solar input (sum of months) = Sum(63)m =											-907.6949 (63)
	148.4391	113.9104	89.3781	44.4701	23.0833	0.0000	0.0000	20.2634	44.6741	90.4081	124.7549	149.4520 (64)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m =											848.8335 (64)
	58.0963	50.9098	52.7681	46.3333	44.7005	38.9311	36.4304	41.2999	41.6439	48.0935	52.0719	56.3717 (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	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4208	58.9944	47.9774	36.3220	27.1511	22.9221	24.7682	32.1946	43.2115	54.8669	64.0378	68.2668 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.6773	402.8143	392.3892	370.1952	342.1794	315.8484	298.2577	294.1207	304.5458	326.7398	354.7556	381.0866 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)	78.0864	75.7587	70.9248	64.3518	60.0814	54.0709	48.9656	55.5106	57.8387	64.6418	72.3221	75.7684 (72)
Total internal gains	656.6575	651.0403	624.7644	584.3419	542.8848	506.3144	485.4644	495.2988	519.0690	559.7215	604.5885	638.5948 (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				4.6400	45.1778		0.6300		0.7000		0.7700		64.0642 (77)
Southwest				1.2000	45.1778		0.6300		0.7000		0.7700		16.5683 (79)
Northwest				6.7000	14.6176		0.6300		0.7000		0.7700		29.9312 (81)
Solar gains	110.5637	169.0605	256.7226	359.5289	414.4633	467.1286	428.0937	383.0805	305.3071	205.7465	133.8670		88.4224 (83)
Total gains	767.2211	820.1007	881.4869	943.8708	957.3480	973.4430	913.5581	878.3792	824.3761	765.4679	738.4555		727.0171 (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	21.1866	21.3747	21.3747	21.4944	21.4944	21.6094	21.6094	21.7195	21.7195	21.5525	21.6094	21.4944
alpha	2.4124	2.4250	2.4250	2.4330	2.4330	2.4406	2.4406	2.4480	2.4480	2.4368	2.4406	2.4330
util living area	0.9272	0.9120	0.8765	0.8102	0.6981	0.5248	0.3912	0.4029	0.6297	0.8123	0.8983	0.9330 (86)
MIT	18.8614	19.0624	19.4837	20.0098	20.5118	20.8389	20.9461	20.9431	20.7286	20.1870	19.4795	18.8581 (87)
Th 2	19.9879	19.9959	19.9959	20.0009	20.0009	20.0057	20.0057	20.0102	20.0102	20.0033	20.0057	20.0009 (88)
util rest of house	0.9175	0.9003	0.8593	0.7820	0.6483	0.4446	0.2846	0.2943	0.5565	0.7774	0.8824	0.9239 (89)
MIT 2	18.0599	18.2620	18.6729	19.1808	19.6433	19.9164	19.9872	19.9905	19.8417	19.3593	18.6813	18.0665 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											

MIT	18.1716	18.3735	18.7859	19.2963	19.7643	20.0449	20.1208	20.1232	19.9653	19.4746	18.7925	18.1767 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1716	18.3735	18.7859	19.2963	19.7643	20.0449	20.1208	20.1232	19.9653	19.4746	18.7925	18.1767 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8951	0.8766	0.8341	0.7589	0.6352	0.4480	0.2976	0.3074	0.5528	0.7555	0.8583	0.9025 (94)
Useful gains	686.7666	718.9052	735.2398	716.2632	608.0807	436.1431	271.8656	270.0121	455.6876	578.3197	633.8098	656.1278 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	1524.3731	1475.6974	1323.3595	1093.6873	784.0392	485.0457	283.2875	282.1329	543.1716	876.9928	1216.1494	1491.3865 (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	623.1793	508.5644	437.5610	271.7453	130.9131	0.0000	0.0000	0.0000	0.0000	222.2127	419.2845	621.4325 (98)
Space heating												3234.8928 (98)
Space heating per m2												30.2439 (99)
										(98) / (4) =		

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3574.4671	0.2160	772.0849 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	946.9673	0.2160	204.5449 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space and water heating			976.6298 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	469.2048	0.5190	243.5173 (268)
Energy saving/generation technologies			
PV Unit	-794.4149	0.5190	-412.3013 (269)
Total kg/year			872.7208 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3574.4671	1.2200	4360.8499 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	946.9673	1.2200	1155.3001 (264)
Space and water heating			5516.1500 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	469.2048	3.0700	1440.4587 (268)
Energy saving/generation technologies			
PV Unit	-794.4149	3.0700	-2438.8536 (269)
Primary energy kWh/year			4901.5051 (272)
Primary energy kWh/m2/year			45.8256 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Built) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	85.1 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	690.71 (P1)
Transmission heat loss coefficient	68.21 (37)
Summer heat loss coefficient	758.92 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
South East	0.000	1.000	None
South West	0.000	1.000	None
North West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
South East	4.6400	127.3119	0.6300	0.7000	0.9000	211.0136
South West	1.2000	127.3119	0.6300	0.7000	0.9000	54.5725
North West	6.7000	106.0502	0.6300	0.7000	0.9000	253.8107
total:						519.3968

	Jun	Jul	Aug	
Solar gains	560	519	455	(P3)
Internal gains	503	482	492	
Total summer gains	1064	1002	947	(P5)
Summer gain/loss ratio	1.40	1.32	1.25	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 85.1)	1.40	1.40	1.40	
Threshold temperature	18.21	20.02	19.95	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			