



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 3 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 217			Issued on Date	10/02/2023
Assessment Reference	AB	Prop Type Ref	Type 4.2		
Property	3 Harding Road, EASTLEIGH, SO50 9RB				
SAP Rating	87 B	DER	13.70	TER	16.99
Environmental	88 B	% DER<TER	19.35		
CO ₂ Emissions (t/year)	1.09	DFEE	45.83	TFEE	50.98
General Requirements Compliance	Pass	% DFEE<TFEE	10.11		
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)	16.99	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.70	kgCO ₂ /m ²	Pass
	-3.29 (-19.4%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.98	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	45.83	kWh/m ² /yr	
	-5.2 (-10.2%)	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	4.98 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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 North East

1.20 m², No overhang

Windows facing South East

4.64 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

4.98 (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	North East	None	0.00					1.20	
Rear Elevation	Window	[1] External Wall	North West	None	0.00					6.70	

14.0 Conservatory

15.0 Draught Proofing

%

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	10.56	0.300	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	0.085	W/m²K
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18.0 Pressure Testing	Yes	
Designed AP ₅₀	6.00	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP ₅₀	4.98	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation	
Summer Overheating	
Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	8.00
Mechanical Ventilation	
Mechanical Ventilation System Present	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

Calculation Type: New Build (As Built)

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/m²K)	Resistance (m²K/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

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

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) 16.99 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.70 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.8 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: 4.98 (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 ESP1 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 North East: 1.20 m², No overhang
Windows facing South East: 4.64 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					4.9800
Infiltration rate					0.4019 (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) =				0.3717 (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	0.4740	0.4647	0.4554	0.4089	0.3996	0.3532	0.3532	0.3439	0.3717	0.3996	0.4182	0.4368 (22b)
Effective ac	0.6123	0.6080	0.6037	0.5836	0.5799	0.5624	0.5624	0.5591	0.5691	0.5799	0.5875	0.5954 (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)							17.6843 (36)
Total fabric heat loss						(33) + (36) =	70.4523 (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	52.8675	52.4909	52.1218	50.3880	50.0636	48.5535	48.5535	48.2739	49.1352	50.0636	50.7199	51.4059 (38)
Heat transfer coeff	123.3198	122.9432	122.5741	120.8403	120.5159	119.0058	119.0058	118.7262	119.5875	120.5159	121.1722	121.8582 (39)
Average = Sum(39)m / 12 =												120.8388 (39)
HLP	1.1530	1.1494	1.1460	1.1298	1.1267	1.1126	1.1126	1.1100	1.1181	1.1267	1.1329	1.1393 (40)
HLP (average)												1.1298 (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)
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 = Sum (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

Northeast			1.2000		11.2829		0.6300		0.7000		0.7700	4.1379 (75)
Southeast			4.6400		36.7938		0.6300		0.7000		0.7700	52.1753 (77)
Northwest			6.7000		11.2829		0.6300		0.7000		0.7700	23.1030 (81)

Solar gains	79.4162	144.3234	221.5036	314.7383	389.3030	402.6616	381.4780	323.3766	253.4010	165.9883	96.7701	66.8975 (83)
Total gains	519.1141	581.4949	642.4496	709.5790	757.4344	745.4492	708.1129	656.7553	600.4995	539.4220	500.3230	493.2300 (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	20.5057	20.5685	20.6305	20.9265	20.9828	21.2491	21.2491	21.2991	21.1457	20.9828	20.8692	20.7517
alpha	2.3670	2.3712	2.3754	2.3951	2.3989	2.4166	2.4166	2.4199	2.4097	2.3989	2.3913	2.3834
util living area	0.9711	0.9607	0.9412	0.9003	0.8279	0.7149	0.5951	0.6400	0.8087	0.9201	0.9608	0.9743 (86)
MIT	18.1497	18.3929	18.8453	19.4778	20.0862	20.5743	20.8097	20.7656	20.3694	19.5987	18.7774	18.1140 (87)
Th 2	19.9578	19.9607	19.9635	19.9766	19.9791	19.9905	19.9905	19.9927	19.9861	19.9791	19.9741	19.9689 (88)
util rest of house	0.9670	0.9551	0.9322	0.8838	0.7955	0.6526	0.4961	0.5456	0.7605	0.9036	0.9543	0.9706 (89)
MIT 2	17.3392	17.5821	18.0317	18.6613	19.2475	19.7020	19.8933	19.8656	19.5270	18.7890	17.9750	17.3110 (90)
Living area fraction	17.4521	17.6950	18.1450	18.7751	19.3643	19.8235	20.0210	19.9910	fLA = Living area / (4) =			
MIT	17.4521	17.6950	18.1450	18.7751	19.3643	19.8235	20.0210	19.9910	19.6443	18.9018	18.0868	17.4229 (92)
Temperature adjustment												0.0000
adjusted MIT	17.4521	17.6950	18.1450	18.7751	19.3643	19.8235	20.0210	19.9910	19.6443	18.9018	18.0868	17.4229 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	494.7879	545.6268	585.5674	609.6448	584.7839	477.6599	353.6230	358.2268	444.8761	475.0563	469.1179	472.4844 (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	1621.9132	1573.0596	1427.3758	1193.3045	923.6714	621.6272	407.1179	426.3438	663.0314	1000.4971	1331.2893	1611.3137 (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	838.5813	690.4348	626.3055	420.2349	252.1323	0.0000	0.0000	0.0000	0.0000	390.9280	620.7634	847.2889 (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) = 4686.6691 (98)
43.8170 (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 5178.6399 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	838.5813	690.4348	626.3055	420.2349	252.1323	0.0000	0.0000	0.0000	0.0000	390.9280	620.7634	847.2889	(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)	926.6091	762.9114	692.0503	464.3480	278.5992	0.0000	0.0000	0.0000	0.0000	431.9646	685.9264	936.2309	(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	89.9222	89.8918	89.8227	89.6667	89.3420	87.3000	87.3000	87.3000	87.3000	89.5975	89.8253	89.9409	(216)
Fuel for water heating, kWh/month	198.2121	173.8542	180.5807	159.1751	154.3738	137.9687	129.4752	146.2628	147.3258	165.3342	178.1210	192.4007	(219)
Water heating fuel used												1963.0843	(219)
Annual totals kWh/year													
Space heating fuel - main system												5178.6399	(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												6993.1881	(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	5178.6399	0.2160	1118.5862	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1963.0843	0.2160	424.0262	(264)
Space and water heating			1542.6124	(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			1465.5222	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7000	(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				30.2384	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				30.2384	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)											(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 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			
Northeast				1.2000	11.2829	0.6300	0.7000	0.7700	4.1379 (75)			
Southeast				4.6400	36.7938	0.6300	0.7000	0.7700	52.1753 (77)			
Northwest				6.7000	11.2829	0.6300	0.7000	0.7700	23.1030 (81)			
Solar gains	79.4162	144.3234	221.5036	314.7383	389.3030	402.6616	381.4780	323.3766	253.4010	165.9883	96.7701	66.8975 (83)
Total gains	531.4826	593.8675	654.8309	721.7300	768.9080	756.2477	718.9197	668.2367	612.6620	551.8147	512.7019	505.6026 (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	0.9992	0.9984	0.9957	0.9841	0.9392	0.8102	0.6408	0.7032	0.9200	0.9906	0.9984	0.9994	(86)	
MIT	19.7872	19.9078	20.1260	20.4364	20.7275	20.9249	20.9838	20.9737	20.8284	20.4611	20.0763	19.7730	(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	0.9989	0.9978	0.9940	0.9773	0.9114	0.7308	0.5179	0.5821	0.8721	0.9855	0.9977	0.9992	(89)	
MIT 2	18.4018	18.5803	18.9010	19.3604	19.7669	20.0135	20.0625	20.0590	19.9092	19.4010	18.8370	18.3893	(90)	
Living area fraction									fLA = Living area / (4) =			0.1393	(91)	
MIT	18.5948	18.7652	19.0717	19.5103	19.9007	20.1404	20.1908	20.1864	20.0373	19.5487	19.0096	18.5820	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.5948	18.7652	19.0717	19.5103	19.9007	20.1404	20.1908	20.1864	20.0373	19.5487	19.0096	18.5820	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9983	0.9966	0.9915	0.9719	0.9057	0.7377	0.5348	0.5983	0.8703	0.9815	0.9965	0.9987	(94)
Useful gains	530.5827	591.8695	649.2916	701.4817	696.3666	557.8475	384.4685	399.8100	533.2038	541.5827	510.9181	504.9539	(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	1616.9761	1563.1301	1412.6371	1173.7530	904.5229	602.6914	390.6125	410.8268	649.3300	987.0278	1321.4639	1605.7162	(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	808.2767	652.6871	567.9291	340.0353	154.8683	0.0000	0.0000	0.0000	0.0000	331.4112	583.5929	818.9672	(98)
Space heating												4257.7678	(98)
Space heating per m2											(98) / (4) =	39.8071	(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													4558.6379 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	808.2767	652.6871	567.9291	340.0353	154.8683	0.0000	0.0000	0.0000	0.0000	331.4112	583.5929	818.9672	(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)	865.3927	698.8085	608.0611	364.0635	165.8118	0.0000	0.0000	0.0000	0.0000	354.8300	624.8318	876.8385	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	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	88.0721	87.9116	87.5424	86.6586	84.7873	80.3000	80.3000	80.3000	80.3000	86.5021	87.6326	80.3000	(216)
Fuel for water heating, kWh/month	244.1695	215.6011	227.3748	205.0828	202.9386	188.7251	180.8130	201.5642	203.7902	213.8860	223.2603	238.1110	(219)
Water heating fuel used												2545.3168	(219)
Annual totals kWh/year													
Space heating fuel - main system												4558.6379	(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												7648.1595	(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	4558.6379	0.2160	984.6658	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2545.3168	0.2160	549.7884	(264)
Space and water heating			1534.4542	(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			1816.8965	(272)
Emissions per m2 for space and water heating			14.3461	(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) = (14.3461 * 1.00) + 2.2767 + 0.3639, rounded to 2 d.p.			16.9900	(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					4.9800
Infiltration rate					0.4019 (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) =		0.3717 (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	0.4740	0.4647	0.4554	0.4089	0.3996	0.3532	0.3532	0.3439	0.3717	0.3996	0.4182	0.4368 (22b)
	0.6123	0.6080	0.6037	0.5836	0.5799	0.5624	0.5624	0.5591	0.5691	0.5799	0.5875	0.5954 (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)							17.6843 (36)
Total fabric heat loss						(33) + (36) =	70.4523 (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	52.8675	52.4909	52.1218	50.3880	50.0636	48.5535	48.5535	48.2739	49.1352	50.0636	50.7199	51.4059 (38)
Average = Sum(39)m / 12 =	123.3198	122.9432	122.5741	120.8403	120.5159	119.0058	119.0058	118.7262	119.5875	120.5159	121.1722	121.8582 (39)
												120.8388 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1530	1.1494	1.1460	1.1298	1.1267	1.1126	1.1126	1.1100	1.1181	1.1267	1.1329	1.1393 (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		
Northeast				1.2000	11.2829	0.6300	0.7000	0.7700	4.1379 (75)			
Southeast				4.6400	36.7938	0.6300	0.7000	0.7700	52.1753 (77)			
Northwest				6.7000	11.2829	0.6300	0.7000	0.7700	23.1030 (81)			
Solar gains	79.4162	144.3234	221.5036	314.7383	389.3030	402.6616	381.4780	323.3766	253.4010	165.9883	96.7701	66.8975 (83)
Total gains	484.8938	548.1173	610.8221	680.3323	729.7363	719.9291	684.4407	630.7118	573.6107	510.0693	468.1896	459.8489 (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	19.1712	19.2299	19.2878	19.5646	19.6172	19.8662	19.8662	19.9130	19.7695	19.6172	19.5110	19.4011
alpha	2.2781	2.2820	2.2859	2.3043	2.3078	2.3244	2.3244	2.3275	2.3180	2.3078	2.3007	2.2934
util living area	0.9714	0.9608	0.9411	0.9003	0.8290	0.7186	0.6014	0.6477	0.8127	0.9215	0.9615	0.9746 (86)
MIT	17.9787	18.2329	18.7065	19.3690	20.0086	20.5278	20.7835	20.7337	20.3077	19.4945	18.6338	17.9419 (87)
Th 2	19.9578	19.9607	19.9635	19.9766	19.9791	19.9905	19.9905	19.9927	19.9861	19.9791	19.9741	19.9689 (88)
util rest of house	0.9675	0.9554	0.9325	0.8842	0.7976	0.6580	0.5039	0.5553	0.7664	0.9058	0.9553	0.9711 (89)
MIT 2	17.1773	17.4313	17.9022	18.5619	19.1800	19.6662	19.8773	19.8450	19.4763	18.6945	17.8406	17.1481 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											
MIT	17.2890	17.5430	18.0142	18.6744	19.2954	19.7862	20.0035	19.9688	19.5922	18.8060	17.9511	17.2586 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.2890	17.5430	18.0142	18.6744	19.2954	19.7862	20.0035	19.9688	19.5922	18.8060	17.9511	17.2586 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9532	0.9380	0.9107	0.8581	0.7721	0.6438	0.5053	0.5528	0.7443	0.8817	0.9381	0.9580 (94)
Ext temp.	462.2187	514.1201	556.2612	583.8255	563.4529	463.4852	345.8483	348.6343	426.9654	449.7270	439.2099	440.5569 (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	1601.7984	1554.3669	1411.3467	1181.1378	915.3725	617.1875	405.0372	423.7089	656.7933	988.9504	1314.8543	1591.3033 (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	847.8473	699.0459	636.1836	430.0648	261.8282	0.0000	0.0000	0.0000	0.0000	401.1822	630.4640	856.1553 (98)
Space heating per m2	(98) / (4) = 44.5285 (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	1118.6549	880.6432	902.3191	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6409	0.7097	0.6772	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	716.9130	624.9857	611.0090	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	951.4377	907.6755	847.2279	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	168.8578	210.3212	175.7469	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			554.9260	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	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	42.2145	52.5803	43.9367	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												138.7315	(107)
Energy for space heating												1.2970	(108)
Energy for space cooling												44.5285	(99)
Total												1.2970	(108)
Dwelling Fabric Energy Efficiency (DFEE)												45.8256	(109)
												45.8	(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) =				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	
Northeast	1.2000	11.2829	0.6300		0.7000	0.7700	4.1379	(75)
Southeast	4.6400	36.7938	0.6300		0.7000	0.7700	52.1753	(77)
Northwest	6.7000	11.2829	0.6300		0.7000	0.7700	23.1030	(81)

Solar gains	79.4162	144.3234	221.5036	314.7383	389.3030	402.6616	381.4780	323.3766	253.4010	165.9883	96.7701	66.8975	(83)
Total gains	484.8938	548.1173	610.8221	680.3323	729.7363	719.9291	684.4407	630.7118	573.6107	510.0693	468.1896	459.8489	(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	0.9989	0.9969	0.9878	0.9500	0.8328	0.6674	0.7341	0.9368	0.9935	0.9990	0.9996	(86)	
MIT	19.7458	19.8672	20.0875	20.4021	20.7016	20.9131	20.9803	20.9675	20.8047	20.4253	20.0367	19.7322	(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	0.9985	0.9957	0.9824	0.9260	0.7566	0.5421	0.6126	0.8956	0.9898	0.9985	0.9995	(89)	
MIT 2	18.8788	19.0025	19.2246	19.5475	19.8365	20.0240	20.0635	20.0606	19.9401	19.5743	19.1831	18.8744	(90)	
Living area fraction									fLA = Living area / (4) =			0.1393	(91)	
MIT	18.9995	19.1229	19.3448	19.6666	19.9570	20.1478	20.1912	20.1869	20.0605	19.6929	19.3020	18.9939	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9995	19.1229	19.3448	19.6666	19.9570	20.1478	20.1912	20.1869	20.0605	19.6929	19.3020	18.9939	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	484.4387	547.0111	607.4375	666.3748	673.3813	550.0089	383.0060	396.8411	513.6205	503.8668	467.2621	459.5307	(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	1662.7547	1603.4590	1443.3288	1191.0458	910.7380	603.4963	390.6523	410.8795	651.8732	1002.9297	1353.9043	1651.6940	(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	876.6671	709.9330	621.9032	377.7631	176.5933	0.0000	0.0000	0.0000	0.0000	371.3028	638.3824	886.9695	(98)	
Space heating												4659.5143	(98)	
Space heating per m ²												43.5631	(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	0.8153	0.8933	0.8589	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	833.6298	719.1243	708.2360	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	951.4377	907.6755	847.2279	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	84.8217	140.2821	103.4100	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												328.5138 (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	21.2054	35.0705	25.8525	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												82.1284 (107)
Space cooling per m2												0.7678 (108)
Energy for space heating												43.5631 (99)
Energy for space cooling												0.7678 (108)
Total												44.3310 (109)
Target Fabric Energy Efficiency (TFEE)												51.0 (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	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					4.9800
Infiltration rate					0.4019 (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) = 0.3717 (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	0.4089	0.3810	0.3810	0.3625	0.3625	0.3439	0.3439	0.3253	0.3253	0.3532	0.3439	0.3625 (22b)
Effective ac	0.5836	0.5726	0.5726	0.5657	0.5657	0.5591	0.5591	0.5529	0.5529	0.5624	0.5591	0.5657 (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)							17.6843 (36)
Total fabric heat loss							(33) + (36) = 70.4523 (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	50.3880	49.4372	49.4372	48.8406	48.8406	48.2739	48.2739	47.7370	47.7370	48.5535	48.2739	48.8406 (38)
Average = Sum(39)m / 12 =	120.8403	119.8895	119.8895	119.2929	119.2929	118.7262	118.7262	118.1893	118.1893	119.0058	118.7262	119.2929 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1298	1.1209	1.1209	1.1153	1.1153	1.1100	1.1100	1.1050	1.1050	1.1126	1.1100	1.1153 (40)
HLP (average)												1.1142 (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
Northeast				1.2000	14.6176		0.6300		0.7000		0.7700		5.3608 (75)
Southeast				4.6400	45.1778		0.6300		0.7000		0.7700		64.0642 (77)
Northwest				6.7000	14.6176		0.6300		0.7000		0.7700		29.9312 (81)
Solar gains	99.3562	154.4001	240.5964	346.0271	405.6357	460.0910	420.5206	371.5818	289.3504	189.6705	120.8290		79.1309 (83)
Total gains	756.0136	805.4404	865.3608	930.3690	948.5205	966.4053	905.9851	866.8806	808.4194	749.3919	725.4176		717.7257 (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	20.9265	21.0925	21.0925	21.1979	21.1979	21.2991	21.2991	21.3959	21.3959	21.2491	21.2991	21.1979
alpha	2.3951	2.4062	2.4062	2.4132	2.4132	2.4199	2.4199	2.4264	2.4264	2.4166	2.4199	2.4132
util living area	0.9297	0.9156	0.8815	0.8163	0.7047	0.5320	0.3982	0.4118	0.6413	0.8202	0.9024	0.9351 (86)
MIT	18.8142	19.0096	19.4347	19.9723	20.4907	20.8297	20.9422	20.9383	20.7102	20.1507	19.4326	18.8101 (87)
Th 2	19.9766	19.9838	19.9838	19.9884	19.9884	19.9927	19.9927	19.9968	19.9968	19.9905	19.9927	19.9884 (88)
util rest of house	0.9202	0.9042	0.8647	0.7884	0.6548	0.4505	0.2888	0.3000	0.5673	0.7859	0.8870	0.9262 (89)
MIT 2	18.0062	18.2024	18.6176	19.1368	19.6153	19.8984	19.9730	19.9756	19.8167	19.3169	18.6272	18.0109 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											
MIT	18.1187	18.3149	18.7314	19.2532	19.7373	20.0282	20.1080	20.1097	19.9411	19.4331	18.7394	18.1222 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1187	18.3149	18.7314	19.2532	19.7373	20.0282	20.1080	20.1097	19.9411	19.4331	18.7394	18.1222 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8979	0.8805	0.8393	0.7647	0.6409	0.4536	0.3021	0.3134	0.5628	0.7634	0.8628	0.9049 (94)
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 (95)
Heat loss rate W	1536.9350	1488.4123	1334.5399	1103.8431	791.7790	490.1224	285.8972	284.7989	548.5341	884.5786	1227.5591	1505.7452 (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

Space heating	638.4152	523.6153	452.5472	282.5238	136.8048	0.0000	0.0000	0.0000	0.0000	232.5136	433.2242	637.0856 (98)
RHI space heating demand												3336.7296 (98)
												3337 (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) =					40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					4.9800
Infiltration rate					0.4019 (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) =		0.3717 (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	0.4740	0.4647	0.4554	0.4089	0.3996	0.3532	0.3532	0.3439	0.3717	0.3996	0.4182	0.4368 (22b)
Effective ac	0.6123	0.6080	0.6037	0.5836	0.5799	0.5624	0.5624	0.5591	0.5691	0.5799	0.5875	0.5954 (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)							17.6843 (36)
Total fabric heat loss						(33) + (36) =	70.4523 (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	52.8675	52.4909	52.1218	50.3880	50.0636	48.5535	48.5535	48.2739	49.1352	50.0636	50.7199	51.4059 (38)
Average = Sum(39)m / 12 =	123.3198	122.9432	122.5741	120.8403	120.5159	119.0058	119.0058	118.7262	119.5875	120.5159	121.1722	121.8582 (39)
												120.8388 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1530	1.1494	1.1460	1.1298	1.1267	1.1126	1.1126	1.1100	1.1181	1.1267	1.1329	1.1393 (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)
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	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	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	Solar input (sum of months) = Sum (63)m =				0.0000 (63)
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)
	Total per year (kWh/year) = Sum (64)m = 1748.3289 (64)											

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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			
Northeast				1.2000	11.2829	0.6300	0.7000	0.7700	4.1379 (75)			
Southeast				4.6400	36.7938	0.6300	0.7000	0.7700	52.1753 (77)			
Northwest				6.7000	11.2829	0.6300	0.7000	0.7700	23.1030 (81)			
Solar gains	79.4162	144.3234	221.5036	314.7383	389.3030	402.6616	381.4780	323.3766	253.4010	165.9883	96.7701	66.8975 (83)
Total gains	736.0736	795.3637	846.2680	899.0802	932.1878	908.9760	866.9424	818.6754	772.4700	725.7098	701.3586	705.4922 (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	20.5057	20.5685	20.6305	20.9265	20.9828	21.2491	21.2491	21.2991	21.1457	20.9828	20.8692	20.7517
alpha	2.3670	2.3712	2.3754	2.3951	2.3989	2.4166	2.4166	2.4199	2.4097	2.3989	2.3913	2.3834
util living area	0.9419	0.9278	0.9021	0.8513	0.7676	0.6426	0.5179	0.5559	0.7297	0.8655	0.9243	0.9468 (86)
MIT	18.4965	18.7219	19.1370	19.7118	20.2499	20.6696	20.8611	20.8303	20.5143	19.8426	19.0868	18.4592 (87)
Th 2	19.9578	19.9607	19.9635	19.9766	19.9791	19.9905	19.9905	19.9927	19.9861	19.9791	19.9741	19.9689 (88)
util rest of house	0.9343	0.9184	0.8886	0.8292	0.7294	0.5772	0.4231	0.4633	0.6732	0.8411	0.9128	0.9399 (89)
MIT 2	17.6796	17.9033	18.3129	18.8802	19.3907	19.7731	19.9223	19.9046	19.6446	19.0167	18.2756	17.6506 (90)
Living area fraction									fLA = Living area / (4) =			0.1393 (91)
MIT	17.7934	18.0173	18.4277	18.9961	19.5104	19.8980	20.0531	20.0336	19.7658	19.1317	18.3886	17.7632 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7934	18.0173	18.4277	18.9961	19.5104	19.8980	20.0531	20.0336	19.7658	19.1317	18.3886	17.7632 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	672.4535	712.2786	730.7631	722.6339	661.1075	518.6433	372.3410	382.6506	509.1620	592.3448	624.1657	649.1778 (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	1664.0040	1612.6856	1462.0308	1220.0133	941.2777	630.4908	410.9368	431.4011	677.5572	1028.2093	1367.8641	1652.7902 (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	737.7136	605.0735	544.0632	358.1132	208.4467	0.0000	0.0000	0.0000	0.0000	324.2832	535.4628	746.6876 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 4059.8438 (98)
Space heating per m2 (98) / (4) = 37.9567 (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	4486.0152 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	737.7136	605.0735	544.0632	358.1132	208.4467	0.0000	0.0000	0.0000	0.0000	324.2832	535.4628	746.6876	(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)	815.1531	668.5895	601.1748	395.7052	230.3278	0.0000	0.0000	0.0000	0.0000	358.3240	591.6716	825.0692	(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	89.8591	89.8242	89.7445	89.5644	89.1981	87.3000	87.3000	87.3000	87.3000	89.4716	89.7432	89.8801	(216)
Fuel for water heating, kWh/month	198.3515	173.9852	180.7380	159.3569	154.6230	137.9687	129.4752	146.2628	147.3258	165.5668	178.2839	192.5307	(219)
Water heating fuel used												1964.4684	(219)
Annual totals kWh/year													
Space heating fuel - main system												4486.0152	(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		6301.9475 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4486.0152	3.4800	156.1133 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1964.4684	3.4800	68.3635 (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			324.8849 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):

Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		0.8979 (257)
SAP rating (Section 12)		87.4737
SAP band		87 (258)
		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	4486.0152	0.2160	968.9793 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.4684	0.2160	424.3252 (264)
Space and water heating			1393.3045 (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			1316.2142 (272)
CO2 emissions per m2			12.3100 (273)
EI value			88.3935
EI rating			88 (274)

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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	$3.48 / 0.8887 = 3.916$, stars = 4
Water heating environmental impact	$0.216 / 0.8887 = 0.2430$, 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	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					4.9800
Infiltration rate					0.4019 (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) =		0.3717 (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	0.4089	0.3810	0.3810	0.3625	0.3625	0.3439	0.3439	0.3253	0.3253	0.3532	0.3439	0.3625 (22b)
Effective ac	0.5836	0.5726	0.5726	0.5657	0.5657	0.5591	0.5591	0.5529	0.5529	0.5624	0.5591	0.5657 (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)							17.6843 (36)
Total fabric heat loss			(33) + (36) =				70.4523 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	50.3880	49.4372	49.4372	48.8406	48.8406	48.2739	48.2739	47.7370	47.7370	48.5535	48.2739	48.8406 (38)
Heat transfer coeff	120.8403	119.8895	119.8895	119.2929	119.2929	118.7262	118.7262	118.1893	118.1893	119.0058	118.7262	119.2929 (39)
Average = Sum(39)m / 12 =												119.1718 (39)
HLP	1.1298	1.1209	1.1209	1.1153	1.1153	1.1100	1.1100	1.1050	1.1050	1.1126	1.1100	1.1153 (40)
HLP (average)												1.1142 (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)
	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	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
Northeast				1.2000	14.6176	0.6300	0.7000				0.7700			5.3608 (75)
Southeast				4.6400	45.1778	0.6300	0.7000				0.7700			64.0642 (77)
Northwest				6.7000	14.6176	0.6300	0.7000				0.7700			29.9312 (81)
Solar gains	99.3562	154.4001	240.5964	346.0271	405.6357	460.0910	420.5206	371.5818	289.3504	189.6705	120.8290			79.1309 (83)
Total gains	756.0136	805.4404	865.3608	930.3690	948.5205	966.4053	905.9851	866.8806	808.4194	749.3919	725.4176			717.7257 (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	20.9265	21.0925	21.0925	21.1979	21.1979	21.2991	21.2991	21.3959	21.3959	21.2491	21.2991	21.1979
alpha	2.3951	2.4062	2.4062	2.4132	2.4132	2.4199	2.4199	2.4264	2.4264	2.4166	2.4199	2.4132
util living area	0.9297	0.9156	0.8815	0.8163	0.7047	0.5320	0.3982	0.4118	0.6413	0.8202	0.9024	0.9351 (86)
MIT	18.8142	19.0096	19.4347	19.9723	20.4907	20.8297	20.9422	20.9383	20.7102	20.1507	19.4326	18.8101 (87)
Th 2	19.9766	19.9838	19.9838	19.9884	19.9884	19.9927	19.9927	19.9968	19.9968	19.9905	19.9927	19.9884 (88)
util rest of house	0.9202	0.9042	0.8647	0.7884	0.6548	0.4505	0.2888	0.3000	0.5673	0.7859	0.8870	0.9262 (89)
MIT 2	18.0062	18.2024	18.6176	19.1368	19.6153	19.8984	19.9730	19.9756	19.8167	19.3169	18.6272	18.0109 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											
MIT	18.1187	18.3149	18.7314	19.2532	19.7373	20.0282	20.1080	20.1097	19.9411	19.4331	18.7394	18.1222 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.1187	18.3149	18.7314	19.2532	19.7373	20.0282	20.1080	20.1097	19.9411	19.4331	18.7394	18.1222 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8979	0.8805	0.8393	0.7647	0.6409	0.4536	0.3021	0.3134	0.5628	0.7634	0.8628	0.9049 (94)
Useful gains	678.8501	709.2229	726.2776	711.4490	607.9016	438.3242	273.6550	271.6684	454.9406	572.0603	625.8587	649.4474 (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	1536.9350	1488.4123	1334.5399	1103.8431	791.7790	490.1224	285.8972	284.7989	548.5341	884.5786	1227.5591	1505.7452 (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	638.4152	523.6153	452.5472	282.5238	136.8048	0.0000	0.0000	0.0000	0.0000	232.5136	433.2242	637.0856 (98)

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Space heating 3336.7296 (98)
Space heating per m2 (98) / (4) = 31.1961 (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 3686.9940 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	638.4152	523.6153	452.5472	282.5238	136.8048	0.0000	0.0000	0.0000	0.0000	232.5136	433.2242	637.0856 (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)	705.4312	578.5804	500.0521	312.1809	151.1655	0.0000	0.0000	0.0000	0.0000	256.9211	478.7008	703.9620 (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	89.7817	89.7439	89.6331	89.4001	88.8647	87.3000	87.3000	87.3000	87.3000	89.2272	89.6141	87.3000 (216)
Fuel for water heating, kWh/month	198.5223	174.1408	180.9627	159.6498	155.2030	137.9687	129.4752	146.2628	147.3258	166.0203	178.5408	192.7091 (219)
Water heating fuel used												1966.7814 (219)
Annual totals kWh/year												
Space heating fuel - main system												3686.9940 (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												5403.5653 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3686.9940	4.2600	157.0659 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1966.7814	4.2600	83.7849 (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			280.4285 (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	3686.9940	0.2160	796.3907 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1966.7814	0.2160	424.8248 (264)
Space and water heating			1221.2155 (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			1091.3564 (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	3686.9940	1.2200	4498.1327 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1966.7814	1.2200	2399.4733 (264)
Space and water heating			6897.6059 (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			6129.4610 (272)
Primary energy kWh/m ² /year			57.3061 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 87
Current environmental impact rating:	B 88

(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 (17.8%)

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	£337	£293	£43
Space heating	£270	£270	£0
Water heating	£84	£52	£32
Lighting	£106	£106	£0
Generated (PV)	-£179	-£179	£0
Total cost of fuels	£281	£248	£32
Total cost of uses	£281	£249	£32
Delivered energy	51 kWh/m ²	41 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	57 kWh/m ²	47 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					4.9800
Infiltration rate					0.4019 (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) =		0.3717 (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	0.4740	0.4647	0.4554	0.4089	0.3996	0.3532	0.3532	0.3439	0.3717	0.3996	0.4182	0.4368 (22b)
	0.6123	0.6080	0.6037	0.5836	0.5799	0.5624	0.5624	0.5591	0.5691	0.5799	0.5875	0.5954 (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)							17.6843 (36)
Total fabric heat loss						(33) + (36) =	70.4523 (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	52.8675	52.4909	52.1218	50.3880	50.0636	48.5535	48.5535	48.2739	49.1352	50.0636	50.7199	51.4059 (38)
Average = Sum(39)m / 12 =	123.3198	122.9432	122.5741	120.8403	120.5159	119.0058	119.0058	118.7262	119.5875	120.5159	121.1722	121.8582 (39)
												120.8388 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1530	1.1494	1.1460	1.1298	1.1267	1.1126	1.1126	1.1100	1.1181	1.1267	1.1329	1.1393 (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	
Northeast				1.2000	11.2829	0.6300		0.7000	0.7700		4.1379 (75)	
Southeast				4.6400	36.7938	0.6300		0.7000	0.7700		52.1753 (77)	
Northwest				6.7000	11.2829	0.6300		0.7000	0.7700		23.1030 (81)	
Solar gains	79.4162	144.3234	221.5036	314.7383	389.3030	402.6616	381.4780	323.3766	253.4010	165.9883	96.7701	66.8975 (83)
Total gains	736.0736	795.3637	846.2680	899.0802	932.1878	908.9760	866.9424	818.6754	772.4700	725.7098	701.3586	705.4922 (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	20.5057	20.5685	20.6305	20.9265	20.9828	21.2491	21.2491	21.2991	21.1457	20.9828	20.8692	20.7517
alpha	2.3670	2.3712	2.3754	2.3951	2.3989	2.4166	2.4166	2.4199	2.4097	2.3989	2.3913	2.3834
util living area	0.9419	0.9278	0.9021	0.8513	0.7676	0.6426	0.5179	0.5559	0.7297	0.8655	0.9243	0.9468 (86)
MIT	18.4965	18.7219	19.1370	19.7118	20.2499	20.6696	20.8611	20.8303	20.5143	19.8426	19.0868	18.4592 (87)
Th 2	19.9578	19.9607	19.9635	19.9766	19.9791	19.9905	19.9905	19.9927	19.9861	19.9791	19.9741	19.9689 (88)
util rest of house	0.9343	0.9184	0.8886	0.8292	0.7294	0.5772	0.4231	0.4633	0.6732	0.8411	0.9128	0.9399 (89)
MIT 2	17.6796	17.9033	18.3129	18.8802	19.3907	19.7731	19.9223	19.9046	19.6446	19.0167	18.2756	17.6506 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	17.7934	18.0173	18.4277	18.9961	19.5104	19.8980	20.0531	20.0336	19.7658	19.1317	18.3886	17.7632 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7934	18.0173	18.4277	18.9961	19.5104	19.8980	20.0531	20.0336	19.7658	19.1317	18.3886	17.7632 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9136	0.8955	0.8635	0.8037	0.7092	0.5706	0.4295	0.4674	0.6591	0.8162	0.8899	0.9202 (94)	
Useful gains	672.4535	712.2786	730.7631	722.6339	661.1075	518.6433	372.3410	382.6506	509.1620	592.3448	624.1657	649.1778 (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	1664.0040	1612.6856	1462.0308	1220.0133	941.2777	630.4908	410.9368	431.4011	677.5572	1028.2093	1367.8641	1652.7902 (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	737.7136	605.0735	544.0632	358.1132	208.4467	0.0000	0.0000	0.0000	0.0000	324.2832	535.4628	746.6876 (98)	
Space heating												4059.8438 (98)	
Space heating per m2												(98) / (4) = 37.9567 (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													4486.0152 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	737.7136	605.0735	544.0632	358.1132	208.4467	0.0000	0.0000	0.0000	0.0000	324.2832	535.4628	746.6876 (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)	815.1531	668.5895	601.1748	395.7052	230.3278	0.0000	0.0000	0.0000	0.0000	358.3240	591.6716	825.0692 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating													
Water heating requirement	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)	
Efficiency of water heater (217)m	89.9341	89.9771	90.0308	90.1224	90.2280	87.3000	87.3000	87.3000	87.3000	89.7601	89.8568	89.9429 (217)	
Fuel for water heating, kWh/month	170.0097	126.6936	100.1720	51.2751	20.7058	3.6844	0.0000	30.4883	56.6512	104.8116	144.6086	168.8199 (219)	
Water heating fuel used												977.9202 (219)	
Annual totals kWh/year													
Space heating fuel - main system													4486.0152 (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)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (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													5365.3993 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4486.0152	3.4800	156.1133 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	977.9202	3.4800	34.0316 (247)	
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (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			297.1480 (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] =	0.8213 (257)
SAP value		88.5431
SAP rating (Section 12)		89 (258)
SAP band		B

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	4486.0152	0.2160	968.9793 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	977.9202	0.2160	211.2308 (264)
Space and water heating			1180.2101 (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			1129.0698 (272)
CO2 emissions per m2			10.5600 (273)
EI value			90.0437
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 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					4.9800
Infiltration rate					0.4019 (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) =		0.3717 (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	0.4089	0.3810	0.3810	0.3625	0.3625	0.3439	0.3439	0.3253	0.3253	0.3532	0.3439	0.3625 (22b)
Effective ac	0.5836	0.5726	0.5726	0.5657	0.5657	0.5591	0.5591	0.5529	0.5529	0.5624	0.5591	0.5657 (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)							17.6843 (36)
Total fabric heat loss						(33) + (36) =	70.4523 (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	50.3880	49.4372	49.4372	48.8406	48.8406	48.2739	48.2739	47.7370	47.7370	48.5535	48.2739	48.8406 (38)
Average = Sum(39)m / 12 =	120.8403	119.8895	119.8895	119.2929	119.2929	118.7262	118.7262	118.1893	118.1893	119.0058	118.7262	119.2929 (39)
												119.1718 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1298	1.1209	1.1209	1.1153	1.1153	1.1100	1.1100	1.1050	1.1050	1.1126	1.1100	1.1153 (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 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
Northeast				1.2000	14.6176		0.6300		0.7000		0.7700		5.3608 (75)
Southeast				4.6400	45.1778		0.6300		0.7000		0.7700		64.0642 (77)
Northwest				6.7000	14.6176		0.6300		0.7000		0.7700		29.9312 (81)
Solar gains	99.3562	154.4001	240.5964	346.0271	405.6357	460.0910	420.5206	371.5818	289.3504	189.6705	120.8290		79.1309 (83)
Total gains	756.0136	805.4404	865.3608	930.3690	948.5205	966.4053	905.9851	866.8806	808.4194	749.3919	725.4176		717.7257 (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	20.9265	21.0925	21.0925	21.1979	21.1979	21.2991	21.2991	21.3959	21.3959	21.2491	21.2991	21.1979
alpha	2.3951	2.4062	2.4062	2.4132	2.4132	2.4199	2.4199	2.4264	2.4264	2.4166	2.4199	2.4132
util living area	0.9297	0.9156	0.8815	0.8163	0.7047	0.5320	0.3982	0.4118	0.6413	0.8202	0.9024	0.9351 (86)
MIT	18.8142	19.0096	19.4347	19.9723	20.4907	20.8297	20.9422	20.9383	20.7102	20.1507	19.4326	18.8101 (87)
Th 2	19.9766	19.9838	19.9838	19.9884	19.9884	19.9927	19.9927	19.9968	19.9968	19.9905	19.9927	19.9884 (88)
util rest of house	0.9202	0.9042	0.8647	0.7884	0.6548	0.4505	0.2888	0.3000	0.5673	0.7859	0.8870	0.9262 (89)
MIT 2	18.0062	18.2024	18.6176	19.1368	19.6153	19.8984	19.9730	19.9756	19.8167	19.3169	18.6272	18.0109 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											

MIT	18.1187	18.3149	18.7314	19.2532	19.7373	20.0282	20.1080	20.1097	19.9411	19.4331	18.7394	18.1222 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1187	18.3149	18.7314	19.2532	19.7373	20.0282	20.1080	20.1097	19.9411	19.4331	18.7394	18.1222 (93)

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3686.9940	0.2160	796.3907 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	946.8084	0.2160	204.5106 (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			1000.9013 (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			896.9923 (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	3686.9940	1.2200	4498.1327 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	946.8084	1.2200	1155.1063 (264)
Space and water heating			5653.2389 (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			5038.5940 (272)
Primary energy kWh/m2/year			47.1073 (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	70.45 (37)
Summer heat loss coefficient	761.16 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South East	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	Specific data or Table 6b g	FF Specific data or Table 6c	Shading	Gains W
North East	1.2000	106.0502	0.6300	0.7000	0.9000	45.4586
South East	4.6400	127.3119	0.6300	0.7000	0.9000	211.0136
North West	6.7000	106.0502	0.6300	0.7000	0.9000	253.8107
total:						510.2830

	Jun	Jul	Aug	
Solar gains	552	510	441	(P3)
Internal gains	503	482	492	
Total summer gains	1055	993	934	(P5)
Summer gain/loss ratio	1.39	1.30	1.23	(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	18.19	20.01	19.93	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			