



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 81 Highwood Avenue
EASTLEIGH, SO50 9QY

Contact: Scott Spearing | BEAT Solutions
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Report Issue Date: 02/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	SAP-0796 (3B4A) - Plot 213				Issued on Date	02/03/2023
Assessment Reference	AB	Prop Type Ref	Type 4.2			
Property	81 Highwood Avenue, EASTLEIGH, SO50 9QY					
SAP Rating	88 B	DER	13.57	TER	16.87	
Environmental	88 B	% DER<TER	19.55			
CO ₂ Emissions (t/year)	1.08	DFEE	46.19	TFEE	50.38	
General Requirements Compliance	Pass	% DFEE<TFEE	8.30			
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk				Assessor ID	p775-0001
Client	Highwood Construction Ltd, HIGHWOOD					

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	16.87	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.57	kgCO ₂ /m ²	Pass
	-3.30 (-19.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.38	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.19	kWh/m ² /yr	
	-4.2 (-8.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.74 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

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Main heating system

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

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North East

6.70 m², No overhang

Windows facing South East

1.20 m², No overhang

Windows facing South West

4.64 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.74 (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 West
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

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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 West							2.16	
Front Elevation	Window	[1] External Wall	South West	None	0.00					3.27	
Front Dormer	Window	[2] Vertical Studwork	South West	None	0.00					1.37	
Side Elevation	Window	[1] External Wall	South East	None	0.00					1.20	
Rear Elevation	Window	[1] External Wall	North East	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

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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 W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

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

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

SUMMARY FOR INPUT DATA

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Description	Gas Boiler	
Percentage of Heat	100	%
Database Ref. No.	17929	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.5	
In Summer	87.3	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	Yes	
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 East	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	£81	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 m² K/W Lower limit = 9.832 m² K/W Average = 9.939 m² K/W
Total correction = 0.0005 m² K/W U-value (unrounded) = 0.1 W/m² 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

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DWELLING AS BUILT

Semi-Detached House, total floor area 107 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.87 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.57 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 46.2 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.74 (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 ESPI 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: 6.70 m², No overhang
Windows facing South East: 1.20 m², No overhang
Windows facing South West: 4.64 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) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.7400
Infiltration rate					0.4399 (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) =		0.4069 (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	0.5188	0.5086	0.4984	0.4476	0.4374	0.3865	0.3865	0.3764	0.4069	0.4374	0.4578	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5957	0.5747	0.5747	0.5708	0.5828	0.5957	0.6048	0.6143 (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	54.7882	54.3371	53.8948	51.8176	51.4290	49.6199	49.6199	49.2848	50.3167	51.4290	52.2152	53.0371 (38)
Heat transfer coeff	125.2405	124.7894	124.3471	122.2699	121.8813	120.0722	120.0722	119.7371	120.7690	121.8813	122.6675	123.4894 (39)
Average = Sum(39)m / 12 =												122.2681 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1709	1.1667	1.1626	1.1431	1.1395	1.1226	1.1226	1.1195	1.1291	1.1395	1.1469	1.1545 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy content (annual)	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum (45)m = 1582.6444 (45)											
	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
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)
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	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				6.7000	11.2829	0.6300	0.7000	0.7700	23.1030 (75)			
Southeast				1.2000	36.7938	0.6300	0.7000	0.7700	13.4936 (77)			
Southwest				4.6400	36.7938	0.6300	0.7000	0.7700	52.1753 (79)			
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660 (83)
Total gains	528.4699	596.0567	658.7230	723.6235	767.5800	753.0647	716.4775	668.4041	616.0605	554.5316	511.2788	501.3985 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1913	20.2643	20.3363	20.6818	20.7478	21.0604	21.0604	21.1193	20.9388	20.7478	20.6148	20.4776
alpha	2.3461	2.3510	2.3558	2.3788	2.3832	2.4040	2.4040	2.4080	2.3959	2.3832	2.3743	2.3652
util living area	0.9701	0.9589	0.9387	0.8976	0.8260	0.7133	0.5932	0.6356	0.8029	0.9165	0.9592	0.9734 (86)
MIT	18.1262	18.3793	18.8369	19.4734	20.0799	20.5712	20.8084	20.7662	20.3737	19.6013	18.7689	18.0943 (87)
Th 2	19.9433	19.9467	19.9501	19.9658	19.9687	19.9824	19.9824	19.9850	19.9771	19.9687	19.9628	19.9565 (88)
util rest of house	0.9658	0.9530	0.9294	0.8806	0.7931	0.6506	0.4935	0.5407	0.7536	0.8993	0.9524	0.9696 (89)
MIT 2	17.3064	17.5592	18.0141	18.6491	19.2336	19.6925	19.8850	19.8590	19.5232	18.7839	17.9589	17.2834 (90)
Living area fraction									fLA = Living area / (4) =			0.1393 (91)
MIT	17.4206	17.6735	18.1288	18.7640	19.3515	19.8149	20.0136	19.9854	19.6416	18.8978	18.0718	17.3963 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2706	17.5235	17.9788	18.6140	19.2015	19.6649	19.8636	19.8354	19.4916	18.7478	17.9218	17.2463 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9504	0.9342	0.9059	0.8520	0.7632	0.6277	0.4803	0.5245	0.7248	0.8720	0.9335	0.9556 (94)
Ext temp.	502.2744	556.8278	596.7139	616.5620	585.8122	472.7178	344.1306	350.5728	446.5227	483.5706	477.2930	479.1188 (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	1624.4412	1575.2747	1427.3503	1187.7264	914.2945	608.1588	391.8719	411.3402	651.1429	993.0654	1327.4800	1611.0830 (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)
	834.8921	684.3963	617.9934	411.2384	244.3908	0.0000	0.0000	0.0000	0.0000	379.0642	612.1347	842.1814 (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) = 4626.2913 (98)
43.2525 (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 5111.9241 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	834.8921	684.3963	617.9934	411.2384	244.3908	0.0000	0.0000	0.0000	0.0000	379.0642	612.1347	842.1814 (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)	922.5327	756.2391	682.8657	454.4070	270.0451	0.0000	0.0000	0.0000	0.0000	418.8554	676.3919	930.5871 (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	89.9201	89.8875	89.8156	89.6533	89.3189	87.3000	87.3000	87.3000	87.3000	89.5774	89.8178	87.3000 (216)
Fuel for water heating, kWh/month	198.2167	173.8626	180.5951	159.1989	154.4138	137.9687	129.4752	146.2628	147.3258	165.3713	178.1358	192.4066 (219)
Water heating fuel used												1963.2334 (219)
Annual totals kWh/year												
Space heating fuel - main system												5111.9241 (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												6926.6213 (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	5111.9241	0.2160	1104.1756 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1963.2334	0.2160	424.0584 (264)
Space and water heating			1528.2340 (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			1451.1437 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5700 (273)

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

	DER	TFA	N	EF	
Total Floor Area		106.9600			13.5700 ZC1
Assumed number of occupants			2.7953		106.9600
CO2 emission factor in Table 12 for electricity displaced from grid				0.5190	2.7953
CO2 emissions from appliances, equation (L14)					0.5190
CO2 emissions from cooking, equation (L16)					14.7986 ZC2
Total CO2 emissions					1.7398 ZC3
Residual CO2 emissions offset from biofuel CHP					30.1084 ZC4
Additional allowable electricity generation, kWh/m²/year					0.0000 ZC5
Resulting CO2 emissions offset from additional allowable electricity generation					0.0000 ZC6
Net CO2 emissions					0.0000 ZC7
					30.1084 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)
Skilings	17.4500		17.4500	0.1300	2.2685		(30)
Total net area of external elements Aum(A, m ²)			207.3300				(31)
Fabric heat loss, W/K = Sum (A x U)	(26)...(30) + (32) =				49.2109		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9894 (36)
Total fabric heat loss	(33) + (36) =						60.2003 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	52.9159	52.5374	52.1664	50.4240	50.0980	48.5804	48.5804	48.2993	49.1649	50.0980	50.7575	51.4470 (38)
Heat transfer coeff	113.1162	112.7377	112.3667	110.6243	110.2983	108.7807	108.7807	108.4996	109.3652	110.2983	110.9578	111.6473 (39)
Average = Sum(39)m / 12 =												110.6227 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0576	1.0540	1.0505	1.0343	1.0312	1.0170	1.0170	1.0144	1.0225	1.0312	1.0374	1.0438 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7953 (42)
Average daily hot water use (litres/day)												100.5882 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy content (annual)	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1582.6444 (45)
	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.9589	48.6130	48.1831	44.6446	46.1328	48.1831	48.6130	50.9589	49.3151	50.9589	(61)
Total heat required for water heating calculated for each month	215.0453	189.5384	199.0494	177.7219	172.0662	151.5463	145.1929	161.8560	163.6436	185.0159	195.6487	209.8678	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	215.0453	189.5384	199.0494	177.7219	172.0662	151.5463	145.1929	161.8560	163.6436	185.0159	195.6487	209.8678	(64)
Heat gains from water heating, kWh/month	67.2984	59.2243	61.9798	55.0820	53.2369	46.7060	44.4707	49.8420	50.4009	57.3137	60.9847	65.5769	(65)

5. Internal gains (see Table 5 and 5a)													
Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.5683	23.5977	19.1910	14.5288	10.8604	9.1688	9.9073	12.8778	17.2846	21.9468	25.6151	27.3067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	267.1138	269.8856	262.9007	248.0308	229.2602	211.6184	199.8327	197.0609	204.0457	218.9157	237.6863	255.3280	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	36.9765	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	(71)
Water heating gains (Table 5)	90.4549	88.1313	83.3062	76.5027	71.5550	64.8694	59.7724	66.9920	70.0013	77.0345	84.7010	88.1410	(72)
Total internal gains	452.0664	449.5441	433.3273	406.9917	379.6050	353.5861	337.4417	344.8601	359.2610	385.8263	415.9318	438.7052	(73)

6. Solar gains													
[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	6.7000	11.2829	0.6300	0.7000	0.7700	23.1030	(75)						
Southeast	1.2000	36.7938	0.6300	0.7000	0.7700	13.4936	(77)						
Southwest	4.6400	36.7938	0.6300	0.7000	0.7700	52.1753	(79)						
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660	(83)
Total gains	540.8383	608.4294	671.1044	735.7745	779.0536	763.8632	727.2842	679.8855	628.2231	566.9243	523.6576	513.7712	(84)

7. Mean internal temperature (heating season)													
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.6651	65.8855	66.1030	67.1442	67.3426	68.2821	68.2821	68.4590	67.9172	67.3426	66.9424	66.5290	
alpha	5.3777	5.3924	5.4069	5.4763	5.4895	5.5521	5.5521	5.5639	5.5278	5.4895	5.4628	5.4353	
util living area	0.9991	0.9982	0.9951	0.9826	0.9362	0.8055	0.6345	0.6938	0.9129	0.9893	0.9982	0.9994	(86)
MIT	19.7955	19.9207	20.1402	20.4479	20.7340	20.9272	20.9846	20.9754	20.8372	20.4739	20.0860	19.7803	(87)
Th 2	20.0356	20.0386	20.0414	20.0549	20.0574	20.0692	20.0692	20.0714	20.0646	20.0574	20.0523	20.0470	(88)
util rest of house	0.9988	0.9975	0.9933	0.9753	0.9075	0.7255	0.5123	0.5731	0.8623	0.9836	0.9974	0.9991	(89)
MIT 2	18.4140	18.5991	18.9216	19.3765	19.7750	20.0154	20.0628	20.0599	19.9190	19.4192	18.8511	18.3999	(90)
Living area fraction									fLA = Living area / (4) =			0.1393	(91)
MIT	18.6065	18.7832	19.0913	19.5258	19.9086	20.1424	20.1912	20.1874	20.0469	19.5662	19.0232	18.5922	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6065	18.7832	19.0913	19.5258	19.9086	20.1424	20.1912	20.1874	20.0469	19.5662	19.0232	18.5922	(93)

8. Space heating requirement													
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	539.8450	606.1452	664.7980	713.5484	702.5753	559.5646	384.8197	400.6873	540.9606	555.2010	521.6508	513.0597	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1618.2908	1565.1566	1414.8460	1175.4679	905.3916	602.9107	390.6559	410.9350	650.3845	988.9514	1322.9681	1606.8538	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	802.3637	644.4556	558.0358	332.5820	150.8953	0.0000	0.0000	0.0000	0.0000	322.7103	576.9485	813.7828	(98)
Space heating												4201.7740	(98)
Space heating per m2												39.2836	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4498.6874	0.2160	971.7165 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2546.0318	0.2160	549.9429 (264)
Space and water heating			1521.6594 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	469.2048	0.5190	243.5173 (268)
Total CO2, kg/m2/year			1804.1016 (272)
Emissions per m2 for space and water heating			14.2264 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2767 (272b)
Emissions per m2 for pumps and fans			0.3639 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2264 * 1.00) + 2.2767 + 0.3639, rounded to 2 d.p.			16.8700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.7400
Infiltration rate					0.4399 (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) =				0.4069 (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	0.5188	0.5086	0.4984	0.4476	0.4374	0.3865	0.3865	0.3764	0.4069	0.4374	0.4578	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5957	0.5747	0.5747	0.5708	0.5828	0.5957	0.6048	0.6143 (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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.7882	54.3371	53.8948	51.8176	51.4290	49.6199	49.6199	49.2848	50.3167	51.4290	52.2152	53.0371 (38)
Heat transfer coeff	125.2405	124.7894	124.3471	122.2699	121.8813	120.0722	120.0722	119.7371	120.7690	121.8813	122.6675	123.4894 (39)
Average = Sum(39)m / 12 =												122.2681 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1709	1.1667	1.1626	1.1431	1.1395	1.1226	1.1226	1.1195	1.1291	1.1395	1.1469	1.1545 (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)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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			6.7000	11.2829		0.6300		0.7000		0.7700	23.1030 (75)	
Southeast			1.2000	36.7938		0.6300		0.7000		0.7700	13.4936 (77)	
Southwest			4.6400	36.7938		0.6300		0.7000		0.7700	52.1753 (79)	
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660 (83)
Total gains	494.2495	562.6791	627.0955	694.3768	739.8819	727.5446	692.8052	642.3606	589.1718	525.1789	479.1454	468.0174 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	18.8772	18.9454	19.0128	19.3358	19.3975	19.6897	19.6897	19.7448	19.5761	19.3975	19.2731	19.1449
alpha	2.2585	2.2630	2.2675	2.2891	2.2932	2.3126	2.3126	2.3163	2.3051	2.2932	2.2849	2.2763
util living area	0.9704	0.9590	0.9386	0.8976	0.8270	0.7170	0.5993	0.6432	0.8068	0.9178	0.9598	0.9737 (86)
MIT	17.9555	18.2199	18.6987	19.3650	20.0025	20.5248	20.7823	20.7347	20.3127	19.4979	18.6258	17.9226 (87)
Th 2	19.9433	19.9467	19.9501	19.9658	19.9687	19.9824	19.9824	19.9850	19.9771	19.9687	19.9628	19.9565 (88)
util rest of house	0.9663	0.9533	0.9296	0.8810	0.7951	0.6558	0.5012	0.5501	0.7593	0.9014	0.9533	0.9701 (89)
MIT 2	17.1450	17.4092	17.8854	18.5503	19.1664	19.6568	19.8690	19.8386	19.4733	18.6904	17.8253	17.1209 (90)
Living area fraction	17.2579	17.5222	17.9987	18.6638	19.2829	19.7777	19.9962	19.9635	19.5902	18.8029	17.9368	17.2325 (92)
MIT	17.2579	17.5222	17.9987	18.6638	19.2829	19.7777	19.9962	19.9635	19.5902	18.8029	17.9368	17.2325 (93)
Temperature adjustment	17.2579	17.5222	17.9987	18.6638	19.2829	19.7777	19.9962	19.9635	19.5902	18.8029	17.9368	17.2325 (93)
adjusted MIT	17.2579	17.5222	17.9987	18.6638	19.2829	19.7777	19.9962	19.9635	19.5902	18.8029	17.9368	17.2325 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	470.3055	526.2039	568.8332	593.3512	569.2712	466.8178	348.2580	351.8829	434.4938	460.4503	448.2954	447.7091 (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	1622.8585	1575.1115	1429.8342	1193.8219	924.2110	621.7013	407.7928	426.6780	663.0494	999.7772	1329.3204	1609.3804 (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	857.4994	704.8659	640.5848	432.3389	264.0752	0.0000	0.0000	0.0000	0.0000	401.2593	634.3380	864.2834 (98)
Space heating												4799.2449 (98)
Space heating per m ²												(98) / (4) = 44.8695 (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	1128.6782	888.5339	910.0022	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6401	0.7092	0.6788	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	722.4129	630.1713	617.7480	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	960.3390	917.4522	860.8434	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	171.3068	213.7370	180.8630	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												565.9068	(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	42.8267	53.4342	45.2158	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												141.4767	(107)
Space cooling per m2												1.3227	(108)
Energy for space heating												44.8695	(99)
Energy for space cooling												1.3227	(108)
Total												46.1922	(109)
Dwelling Fabric Energy Efficiency (DFEE)												46.2	(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 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				6.7000	11.2829	0.6300	0.7000	0.7700	23.1030 (75)			
Southeast				1.2000	36.7938	0.6300	0.7000	0.7700	13.4936 (77)			
Southwest				4.6400	36.7938	0.6300	0.7000	0.7700	52.1753 (79)			
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660 (83)
Total gains	494.2495	562.6791	627.0955	694.3768	739.8819	727.5446	692.8052	642.3606	589.1718	525.1789	479.1454	468.0174 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	65.6651	65.8855	66.1030	67.1442	67.3426	68.2821	68.2821	68.4590	67.9172	67.3426	66.9424	66.5290		
alpha	5.3777	5.3924	5.4069	5.4763	5.4895	5.5521	5.5521	5.5639	5.5278	5.4895	5.4628	5.4353		
util living area	0.9995	0.9988	0.9965	0.9866	0.9473	0.8281	0.6608	0.7244	0.9303	0.9925	0.9988	0.9996	(86)	
MIT	19.7541	19.8801	20.1018	20.4138	20.7084	20.9157	20.9813	20.9696	20.8144	20.4383	20.0464	19.7395	(87)	
Th 2	20.0356	20.0386	20.0414	20.0549	20.0574	20.0692	20.0692	20.0714	20.0646	20.0574	20.0523	20.0470	(88)	
util rest of house	0.9993	0.9983	0.9951	0.9808	0.9223	0.7512	0.5360	0.6029	0.8864	0.9884	0.9983	0.9995	(89)	
MIT 2	18.8871	19.0153	19.2388	19.5589	19.8425	20.0256	20.0638	20.0614	19.9477	19.5871	19.1928	18.8817	(90)	
Living area fraction									fLA = Living area / (4) =			0.1393	(91)	
MIT	19.0079	19.1358	19.3590	19.6780	19.9632	20.1496	20.1916	20.1879	20.0685	19.7057	19.3117	19.0012	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.0079	19.1358	19.3590	19.6780	19.9632	20.1496	20.1916	20.1879	20.0685	19.7057	19.3117	19.0012	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	493.7410	561.3946	623.1856	678.8928	680.1025	552.0049	383.4423	397.9530	522.3977	517.9392	478.0856	467.6643	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1663.6960	1604.9128	1444.9225	1192.3072	911.4131	603.6866	390.6944	410.9854	652.7411	1004.3390	1354.9843	1652.5081	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	870.4465	701.2443	611.3723	369.6584	172.0951	0.0000	0.0000	0.0000	0.0000	361.8815	631.3670	881.5238	(98)
Space heating												4599.5888	(98)
Space heating per m2												43.0029	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1022.5383	804.9769	824.5972	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8196	0.8970	0.8653	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	838.0478	722.0261	713.5019	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	960.3390	917.4522	860.8434	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Month fraction	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	88.0497	145.3970	109.6221	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												343.0688 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	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	22.0124	36.3493	27.4055	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												85.7672 (107)
Space cooling per m2												0.8019 (108)
Energy for space heating												43.0029 (99)
Energy for space cooling												0.8019 (108)
Total												43.8047 (109)
Target Fabric Energy Efficiency (TFEE)												50.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.7400
Infiltration rate					0.4399 (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) =		0.4069 (21)

Wind speed	Jan 4.4000	Feb 4.1000	Mar 4.1000	Apr 3.9000	May 3.9000	Jun 3.7000	Jul 3.7000	Aug 3.5000	Sep 3.5000	Oct 3.8000	Nov 3.7000	Dec 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	0.4476	0.4171	0.4171	0.3967	0.3967	0.3764	0.3764	0.3560	0.3560	0.3865	0.3764	0.3967 (22b)
Effective ac	0.6002	0.5870	0.5870	0.5787	0.5787	0.5708	0.5708	0.5634	0.5634	0.5747	0.5708	0.5787 (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 51.8176	Feb 50.6785	Mar 50.6785	Apr 49.9638	May 49.9638	Jun 49.2848	Jul 49.2848	Aug 48.6416	Sep 48.6416	Oct 49.6199	Nov 49.2848	Dec 49.9638 (38)
Heat transfer coeff	122.2699	121.1308	121.1308	120.4161	120.4161	119.7371	119.7371	119.0939	119.0939	120.0722	119.7371	120.4161 (39)
Average = Sum(39)m / 12 =												120.2709 (39)
HLP	Jan 1.1431	Feb 1.1325	Mar 1.1325	Apr 1.1258	May 1.1258	Jun 1.1195	Jul 1.1195	Aug 1.1134	Sep 1.1134	Oct 1.1226	Nov 1.1195	Dec 1.1258 (40)
HLP (average)												1.1244 (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				6.7000	14.6176		0.6300	0.7000	0.7700	29.9312 (75)		
Southeast				1.2000	45.1778		0.6300	0.7000	0.7700	16.5683 (77)		
Southwest				4.6400	45.1778		0.6300	0.7000	0.7700	64.0642 (79)		
Solar gains	110.5637	169.0605	256.7226	359.5289	414.4633	467.1286	428.0937	383.0805	305.3071	205.7465	133.8670	88.4224 (83)
Total gains	767.2211	820.1007	881.4869	943.8708	957.3480	973.4430	913.5581	878.3792	824.3761	765.4679	738.4555	727.0171 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.6818	20.8763	20.8763	21.0002	21.0002	21.1193	21.1193	21.2334	21.2334	21.0604	21.1193	21.0002
alpha	2.3788	2.3918	2.3918	2.4000	2.4000	2.4080	2.4080	2.4156	2.4156	2.4040	2.4080	2.4000
util living area	0.9282	0.9133	0.8786	0.8137	0.7036	0.5317	0.3979	0.4096	0.6359	0.8157	0.8998	0.9338 (86)
MIT	18.8014	19.0052	19.4325	19.9694	20.4859	20.8273	20.9413	20.9381	20.7124	20.1541	19.4330	18.8010 (87)
Th 2	19.9658	19.9744	19.9744	19.9798	19.9798	19.9850	19.9850	19.9899	19.9899	19.9824	19.9850	19.9798 (88)
util rest of house	0.9185	0.9016	0.8614	0.7854	0.6533	0.4498	0.2878	0.2975	0.5615	0.7807	0.8840	0.9247 (89)
MIT 2	17.9860	18.1913	18.6084	19.1273	19.6040	19.8897	19.9651	19.9687	19.8120	19.3134	18.6218	17.9961 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											
MIT	18.0996	18.3047	18.7232	19.2446	19.7268	20.0203	20.1011	20.1038	19.9374	19.4305	18.7348	18.1082 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.9496	18.1547	18.5732	19.0946	19.5768	19.8703	19.9511	19.9538	19.7874	19.2805	18.5848	17.9582 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8936	0.8750	0.8322	0.7563	0.6307	0.4396	0.2839	0.2933	0.5447	0.7515	0.8561	0.9010 (94)
Ext temp.	685.6188	717.6146	733.5882	713.8593	603.8212	427.9683	259.3302	257.5886	449.0122	575.2591	632.1825	655.0220 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	1534.4389	1484.4211	1329.1912	1095.1413	779.9156	475.3960	269.5430	268.4114	534.4205	874.1900	1219.5039	1500.1693 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	631.5222	515.2940	443.1287	274.5230	131.0142	0.0000	0.0000	0.0000	0.0000	222.4045	422.8714	628.7896 (98)
RHI space heating demand												3269.5476 (98)
												3270 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.7400
Infiltration rate					0.4399 (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) =		0.4069 (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	0.5188	0.5086	0.4984	0.4476	0.4374	0.3865	0.3865	0.3764	0.4069	0.4374	0.4578	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5957	0.5747	0.5747	0.5708	0.5828	0.5957	0.6048	0.6143 (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	54.7882	54.3371	53.8948	51.8176	51.4290	49.6199	49.6199	49.2848	50.3167	51.4290	52.2152	53.0371 (38)
Heat transfer coeff	125.2405	124.7894	124.3471	122.2699	121.8813	120.0722	120.0722	119.7371	120.7690	121.8813	122.6675	123.4894 (39)
Average = Sum(39)m / 12 =												122.2681 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1709	1.1667	1.1626	1.1431	1.1395	1.1226	1.1226	1.1195	1.1291	1.1395	1.1469	1.1545 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy conte	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Energy content (annual)	Total = Sum (45)m =											1582.6444 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =											0.0000 (63)	
Output from w/h	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (64)
Total per year (kWh/year) = Sum (64)m =											1748.3289 (64)	
Heat gains from water heating, kWh/month	58.0963	50.9098	52.7681	46.3333	44.7005	38.9311	36.4304	41.2999	41.6439	48.0935	52.0719	56.3717 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	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 m ²		Solar flux Table 6a W/m ²		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	6.7000		11.2829		0.6300		0.7000		0.7700		23.1030 (75)	
Southeast	1.2000		36.7938		0.6300		0.7000		0.7700		13.4936 (77)	
Southwest	4.6400		36.7938		0.6300		0.7000		0.7700		52.1753 (79)	
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258	75.0660 (83)
Total gains	745.4294	809.9256	862.5414	913.1246	942.3334	916.5915	875.3069	830.3242	788.0311	740.8194	712.3143	713.6607 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1913	20.2643	20.3363	20.6818	20.7478	21.0604	21.0604	21.1193	20.9388	20.7478	20.6148	20.4776
alpha	2.3461	2.3510	2.3558	2.3788	2.3832	2.4040	2.4040	2.4080	2.3959	2.3832	2.3743	2.3652
util living area	0.9409	0.9260	0.8997	0.8490	0.7663	0.6418	0.5170	0.5530	0.7250	0.8620	0.9226	0.9459 (86)
MIT	18.4698	18.7045	19.1248	19.7046	20.2422	20.6660	20.8594	20.8299	20.5155	19.8415	19.0752	18.4368 (87)
Th 2	19.9433	19.9467	19.9501	19.9658	19.9687	19.9824	19.9824	19.9850	19.9771	19.9687	19.9628	19.9565 (88)
util rest of house	0.9332	0.9162	0.8859	0.8264	0.7277	0.5760	0.4216	0.4600	0.6678	0.8371	0.9109	0.9388 (89)
MIT 2	17.6435	17.8765	18.2914	18.8651	19.3754	19.7631	19.9137	19.8971	19.6378	19.0076	18.2564	17.6201 (90)
Living area fraction	17.7586	17.9918	18.4075	18.9821	19.4962	19.8889	20.0454	20.0271	19.7600	19.1238	18.3704	17.7338 (91)
MIT	17.7586	17.9918	18.4075	18.9821	19.4962	19.8889	20.0454	20.0271	19.7600	19.1238	18.3704	17.7338 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6086	17.8418	18.2575	18.8321	19.3462	19.7389	19.8954	19.8771	19.6100	18.9738	18.2204	17.5838 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9102	0.8908	0.8574	0.7964	0.7005	0.5584	0.4127	0.4490	0.6439	0.8070	0.8850	0.9171 (94)
Useful gains	678.5159	721.4676	739.5852	727.2194	660.1043	511.7912	361.2305	372.8143	507.4077	597.8050	630.3990	654.5187 (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	1666.7736	1615.0040	1462.0162	1214.3915	931.9281	617.0397	395.6892	416.3325	665.4404	1020.6073	1364.1149	1652.7618 (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	735.2638	600.4564	537.4886	350.7640	202.2369	0.0000	0.0000	0.0000	0.0000	314.5649	528.2755	742.6928 (98)

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 4011.7428 (98)
Space heating per m2 (98) / (4) = 37.5069 (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 4432.8650 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	735.2638	600.4564	537.4886	350.7640	202.2369	0.0000	0.0000	0.0000	0.0000	314.5649	528.2755	742.6928 (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)	812.4462	663.4878	593.9101	387.5845	223.4662	0.0000	0.0000	0.0000	0.0000	347.5855	583.7298	820.6551 (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	89.8573	89.8201	89.7375	89.5506	89.1747	87.3000	87.3000	87.3000	87.3000	89.4503	89.7354	87.3000 (216)
Fuel for water heating, kWh/month	198.3552	173.9931	180.7522	159.3815	154.6636	137.9687	129.4752	146.2628	147.3258	165.6063	178.2994	192.5364 (219)
Water heating fuel used												1964.6203 (219)
Annual totals kWh/year												
Space heating fuel - main system												4432.8650 (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												6248.9491 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4432.8650	3.4800	154.2637 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1964.6203	3.4800	68.3688 (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			323.0406 (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] = 0.8928 (257)
SAP value 87.5448
SAP rating (Section 12) 88 (258)
SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4432.8650	0.2160	957.4988 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1964.6203	0.2160	424.3580 (264)
Space and water heating			1381.8568 (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			1304.7665 (272)
CO2 emissions per m2			12.2000 (273)
EI value			88.4944
EI rating			88 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8887 = 3.916$, stars = 4
Water heating environmental impact	$0.216 / 0.8887 = 0.2431$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.7400
Infiltration rate					0.4399 (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) =		0.4069 (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	0.4476	0.4171	0.4171	0.3967	0.3967	0.3764	0.3764	0.3560	0.3560	0.3865	0.3764	0.3967 (22b)
Effective ac	0.6002	0.5870	0.5870	0.5787	0.5787	0.5708	0.5708	0.5634	0.5634	0.5747	0.5708	0.5787 (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	51.8176	50.6785	50.6785	49.9638	49.9638	49.2848	49.2848	48.6416	48.6416	49.6199	49.2848	49.9638 (38)
Average = Sum(39)m / 12 =	122.2699	121.1308	121.1308	120.4161	120.4161	119.7371	119.7371	119.0939	119.0939	120.0722	119.7371	120.4161 (39)
												120.2709 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1431	1.1325	1.1325	1.1258	1.1258	1.1195	1.1195	1.1134	1.1134	1.1226	1.1195	1.1258 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Average daily hot water use (litres/day)												100.5882 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy content (annual)	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum (45)m = 1582.6444 (45)											
	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Output from w/h	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (64)
								Total per year (kWh/year) = Sum (64)m =				1748.3289 (64)
Heat gains from water heating, kWh/month	58.0963	50.9098	52.7681	46.3333	44.7005	38.9311	36.4304	41.2999	41.6439	48.0935	52.0719	56.3717 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176	167.7176 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	66.4208	58.9944	47.9774	36.3220	27.1511	22.9221	24.7682	32.1946	43.2115	54.8669	64.0378	68.2668 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	398.6773	402.8143	392.3892	370.1952	342.1794	315.8484	298.2577	294.1207	304.5458	326.7398	354.7556	381.0866 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671	54.5671 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117	-111.8117 (71)
Water heating gains (Table 5)	78.0864	75.7587	70.9248	64.3518	60.0814	54.0709	48.9656	55.5106	57.8387	64.6418	72.3221	75.7684 (72)
Total internal gains	656.6575	651.0403	624.7644	584.3419	542.8848	506.3144	485.4644	495.2988	519.0690	559.7215	604.5885	638.5948 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
Northeast					6.7000	14.6176		0.6300	0.7000	0.7700		29.9312 (75)
Southeast					1.2000	45.1778		0.6300	0.7000	0.7700		16.5683 (77)
Southwest					4.6400	45.1778		0.6300	0.7000	0.7700		64.0642 (79)
Solar gains	110.5637	169.0605	256.7226	359.5289	414.4633	467.1286	428.0937	383.0805	305.3071	205.7465	133.8670	88.4224 (83)
Total gains	767.2211	820.1007	881.4869	943.8708	957.3480	973.4430	913.5581	878.3792	824.3761	765.4679	738.4555	727.0171 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.6818	20.8763	20.8763	21.0002	21.0002	21.1193	21.1193	21.2334	21.2334	21.0604	21.1193	21.0002
alpha	2.3788	2.3918	2.3918	2.4000	2.4000	2.4080	2.4080	2.4156	2.4156	2.4040	2.4080	2.4000
util living area	0.9282	0.9133	0.8786	0.8137	0.7036	0.5317	0.3979	0.4096	0.6359	0.8157	0.8998	0.9338 (86)
MIT	18.8014	19.0052	19.4325	19.9694	20.4859	20.8273	20.9413	20.9381	20.7124	20.1541	19.4330	18.8010 (87)
Th 2	19.9658	19.9744	19.9744	19.9798	19.9798	19.9850	19.9850	19.9899	19.9899	19.9824	19.9850	19.9798 (88)
util rest of house	0.9185	0.9016	0.8614	0.7854	0.6533	0.4498	0.2878	0.2975	0.5615	0.7807	0.8840	0.9247 (89)
MIT 2	17.9860	18.1913	18.6084	19.1273	19.6040	19.8897	19.9651	19.9687	19.8120	19.3134	18.6218	17.9961 (90)
Living area fraction	18.0996	18.3047	18.7232	19.2446	19.7268	20.0203	20.1011	20.1038	19.9374	19.4305	18.7348	18.1082 (91)
MIT	18.0996	18.3047	18.7232	19.2446	19.7268	20.0203	20.1011	20.1038	19.9374	19.4305	18.7348	18.1082 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9496	18.1547	18.5732	19.0946	19.5768	19.8703	19.9511	19.9538	19.7874	19.2805	18.5848	17.9582 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8936	0.8750	0.8322	0.7563	0.6307	0.4396	0.2839	0.2933	0.5447	0.7515	0.8561	0.9010 (94)
Ext temp.	685.6188	717.6146	733.5882	713.8593	603.8212	427.9683	259.3302	257.5886	449.0122	575.2591	632.1825	655.0220 (95)
Heat loss rate W	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Month fracti	1534.4389	1484.4211	1329.1912	1095.1413	779.9156	475.3960	269.5430	268.4114	534.4205	874.1900	1219.5039	1500.1693 (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)
	631.5222	515.2940	443.1287	274.5230	131.0142	0.0000	0.0000	0.0000	0.0000	222.4045	422.8714	628.7896 (98)

FULL SAP CALCULATION PRINTOUT

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

Space heating 3269.5476 (98)
Space heating per m2 (98) / (4) = 30.5679 (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													3612.7598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	631.5222	515.2940	443.1287	274.5230	131.0142	0.0000	0.0000	0.0000	0.0000	222.4045	422.8714	628.7896	(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)	697.8145	569.3856	489.6449	303.3403	144.7671	0.0000	0.0000	0.0000	0.0000	245.7509	467.2613	694.7951	(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	89.7757	89.7346	89.6198	89.3793	88.8301	87.3000	87.3000	87.3000	87.3000	89.1930	89.5985	87.3000	(216)
(217)m	89.7757	89.7346	89.6198	89.3793	88.8301	87.3000	87.3000	87.3000	87.3000	89.1930	89.5985	89.7897	(217)
Fuel for water heating, kWh/month	198.5357	174.1588	180.9896	159.6870	155.2634	137.9687	129.4752	146.2628	147.3258	166.0840	178.5719	192.7246	(219)
Water heating fuel used												1967.0476	(219)
Annual totals kWh/year													
Space heating fuel - main system												3612.7598	(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												5329.5973	(238)

10a. Fuel costs - using BEDF prices (512)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3612.7598	9.7400	351.8828 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1967.0476	9.7400	191.5904 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	469.2048	36.8500	172.9020 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-794.4149	36.8500	-292.7419 (252)
Total energy cost			555.2708 (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	3612.7598	0.2160	780.3561 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1967.0476	0.2160	424.8823 (264)
Space and water heating			1205.2384 (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			1075.3794 (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	3612.7598	1.2200	4407.5669 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1967.0476	1.2200	2399.7981 (264)
Space and water heating			6807.3650 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	469.2048	3.0700	1440.4587 (268)

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Energy saving/generation technologies			
PV Unit	-794.4149	3.0700	-2438.8536 (269)
Primary energy kWh/year			6039.2201 (272)
Primary energy kWh/m2/year			56.4624 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
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	-£ 81	-194 kg (18.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 1.82 kg/m²	B 89	B 90
Total Savings	£81 1.82 kg/m²		

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

Fuel prices for cost data on this page from database revision number 512 TEST (15 Feb 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	£201	£219	-£18
Mains gas	£647	£548	£99
Space heating	£484	£484	£0
Water heating	£192	£111	£81
Lighting	£173	£173	£0
Generated (PV)	-£293	-£293	£0
Total cost of fuels	£555	£474	£81
Total cost of uses	£556	£475	£81
Delivered energy	50 kWh/m²	41 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	56 kWh/m²	46 kWh/m²	10 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.7400
Infiltration rate					0.4399 (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) =		0.4069 (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	0.5188	0.5086	0.4984	0.4476	0.4374	0.3865	0.3865	0.3764	0.4069	0.4374	0.4578	0.4781 (22b)
Effective ac	0.6346	0.6293	0.6242	0.6002	0.5957	0.5747	0.5747	0.5708	0.5828	0.5957	0.6048	0.6143 (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	54.7882	54.3371	53.8948	51.8176	51.4290	49.6199	49.6199	49.2848	50.3167	51.4290	52.2152	53.0371 (38)
Heat transfer coeff	125.2405	124.7894	124.3471	122.2699	121.8813	120.0722	120.0722	119.7371	120.7690	121.8813	122.6675	123.4894 (39)
Average = Sum(39)m / 12 =												122.2681 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1709	1.1667	1.1626	1.1431	1.1395	1.1226	1.1226	1.1195	1.1291	1.1395	1.1469	1.1545 (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)
Output from w/h	Solar input (sum of months) = Sum(63)m =											-873.8574 (63)
	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)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m =											877.1207 (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				6.7000	11.2829		0.6300		0.7000		0.7700		23.1030 (75)
Southeast				1.2000	36.7938		0.6300		0.7000		0.7700		13.4936 (77)
Southwest				4.6400	36.7938		0.6300		0.7000		0.7700		52.1753 (79)
Solar gains	88.7719	158.8853	237.7771	328.7827	399.4487	410.2771	389.8425	335.0255	268.9621	181.0980	107.7258		75.0660 (83)
Total gains	745.4294	809.9256	862.5414	913.1246	942.3334	916.5915	875.3069	830.3242	788.0311	740.8194	712.3143		713.6607 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.1913	20.2643	20.3363	20.6818	20.7478	21.0604	21.0604	21.1193	20.9388	20.7478	20.6148	20.4776
alpha	2.3461	2.3510	2.3558	2.3788	2.3832	2.4040	2.4040	2.4080	2.3959	2.3832	2.3743	2.3652
util living area												
	0.9409	0.9260	0.8997	0.8490	0.7663	0.6418	0.5170	0.5530	0.7250	0.8620	0.9226	0.9459 (86)
MIT	18.4698	18.7045	19.1248	19.7046	20.2422	20.6660	20.8594	20.8299	20.5155	19.8415	19.0752	18.4368 (87)
Th 2	19.9433	19.9467	19.9501	19.9658	19.9687	19.9824	19.9824	19.9850	19.9771	19.9687	19.9628	19.9565 (88)
util rest of house												
	0.9332	0.9162	0.8859	0.8264	0.7277	0.5760	0.4216	0.4600	0.6678	0.8371	0.9109	0.9388 (89)
MIT 2	17.6435	17.8765	18.2914	18.8651	19.3754	19.7631	19.9137	19.8971	19.6378	19.0076	18.2564	17.6201 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	17.7586	17.9918	18.4075	18.9821	19.4962	19.8889	20.0454	20.0271	19.7600	19.1238	18.3704	17.7338 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6086	17.8418	18.2575	18.8321	19.3462	19.7389	19.8954	19.8771	19.6100	18.9738	18.2204	17.5838 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9102	0.8908	0.8574	0.7964	0.7005	0.5584	0.4127	0.4490	0.6439	0.8070	0.8850	0.9171 (94)	
Useful gains	678.5159	721.4676	739.5852	727.2194	660.1043	511.7912	361.2305	372.8143	507.4077	597.8050	630.3990	654.5187 (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	1666.7736	1615.0040	1462.0162	1214.3915	931.9281	617.0397	395.6892	416.3325	665.4404	1020.6073	1364.1149	1652.7618 (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	735.2638	600.4564	537.4886	350.7640	202.2369	0.0000	0.0000	0.0000	0.0000	314.5649	528.2755	742.6928 (98)	
Space heating												4011.7428 (98)	
Space heating per m2												37.5069 (99)	

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4432.8650 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	735.2638	600.4564	537.4886	350.7640	202.2369	0.0000	0.0000	0.0000	0.0000	314.5649	528.2755	742.6928 (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)	812.4462	663.4878	593.9101	387.5845	223.4662	0.0000	0.0000	0.0000	0.0000	347.5855	583.7298	820.6551 (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	89.9325	89.9738	90.0259	90.1155	90.2203	87.3000	87.3000	87.3000	87.3000	89.7427	89.8498	89.9404 (217)	
Fuel for water heating, kWh/month	170.0126	126.6984	100.1775	51.2790	20.7075	3.6844	0.0000	30.4883	56.6512	104.8320	144.6198	168.8246 (219)	
Water heating fuel used												977.9753 (219)	
Annual totals kWh/year													
Space heating fuel - main system													4432.8650 (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													5312.3041 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4432.8650	3.4800	154.2637 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	977.9753	3.4800	34.0335 (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			295.3003 (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] =	0.8162 (257)
SAP value		88.6143
SAP rating (Section 12)		B9 (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	4432.8650	0.2160	957.4988 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	977.9753	0.2160	211.2427 (264)
Space and water heating			1168.7415 (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			1117.6012 (272)
CO2 emissions per m2			10.4500 (273)
EI value			90.1449
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	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) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					5.7400
Infiltration rate					0.4399 (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) =		0.4069 (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	0.4476	0.4171	0.4171	0.3967	0.3967	0.3764	0.3764	0.3560	0.3560	0.3865	0.3764	0.3967 (22b)
Effective ac	0.6002	0.5870	0.5870	0.5787	0.5787	0.5708	0.5708	0.5634	0.5634	0.5747	0.5708	0.5787 (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	51.8176	50.6785	50.6785	49.9638	49.9638	49.2848	49.2848	48.6416	48.6416	49.6199	49.2848	49.9638 (38)
Average = Sum(39)m / 12 =	122.2699	121.1308	121.1308	120.4161	120.4161	119.7371	119.7371	119.0939	119.0939	120.0722	119.7371	120.4161 (39)
												120.2709 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1431	1.1325	1.1325	1.1258	1.1258	1.1195	1.1195	1.1134	1.1134	1.1226	1.1195	1.1258 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.7953 (42)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy conte	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Energy content (annual)	Total = Sum(45)m =											1582.6444 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2744 (H8)
Utilisation factor												0.5437 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.5882 (H14)
Volume ratio Veff/V												0.7456 (H15)
Solar storage volume factor												0.9413 (H16)
Solar input												-907.6949 (H17)
Solar input	-29.7976	-42.3703	-72.8244	-98.2570	-114.8374	-123.8154	-117.8626	-107.4241	-83.9413	-57.7271	-35.2427	-23.5948 (63)
	Solar input (sum of months) = Sum(63)m =											-907.6949 (63)
Output from w/h	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)
	Total per year (kWh/year) = Sum(64)m =											848.8335 (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				6.7000	14.6176	0.6300	0.7000	0.7700	29.9312 (75)			
Southeast				1.2000	45.1778	0.6300	0.7000	0.7700	16.5683 (77)			
Southwest				4.6400	45.1778	0.6300	0.7000	0.7700	64.0642 (79)			
Solar gains	110.5637	169.0605	256.7226	359.5289	414.4633	467.1286	428.0937	383.0805	305.3071	205.7465	133.8670	88.4224 (83)
Total gains	767.2211	820.1007	881.4869	943.8708	957.3480	973.4430	913.5581	878.3792	824.3761	765.4679	738.4555	727.0171 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	20.6818	20.8763	20.8763	21.0002	21.0002	21.1193	21.1193	21.2334	21.2334	21.0604	21.1193	21.0002
alpha	2.3788	2.3918	2.3918	2.4000	2.4000	2.4080	2.4080	2.4156	2.4156	2.4040	2.4080	2.4000
util living area	0.9282	0.9133	0.8786	0.8137	0.7036	0.5317	0.3979	0.4096	0.6359	0.8157	0.8998	0.9338 (86)
MIT	18.8014	19.0052	19.4325	19.9694	20.4859	20.8273	20.9413	20.9381	20.7124	20.1541	19.4330	18.8010 (87)
Th 2	19.9658	19.9744	19.9744	19.9798	19.9798	19.9850	19.9850	19.9899	19.9899	19.9824	19.9850	19.9798 (88)
util rest of house	0.9185	0.9016	0.8614	0.7854	0.6533	0.4498	0.2878	0.2975	0.5615	0.7807	0.8840	0.9247 (89)
MIT 2	17.9860	18.1913	18.6084	19.1273	19.6040	19.8897	19.9651	19.9687	19.8120	19.3134	18.6218	17.9961 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											

MIT	18.0996	18.3047	18.7232	19.2446	19.7268	20.0203	20.1011	20.1038	19.9374	19.4305	18.7348	18.1082 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9496	18.1547	18.5732	19.0946	19.5768	19.8703	19.9511	19.9538	19.7874	19.2805	18.5848	17.9582 (93)

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3612.7598	0.2160	780.3561 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	946.9179	0.2160	204.5343 (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			984.8904 (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			880.9813 (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	3612.7598	1.2200	4407.5669 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	946.9179	1.2200	1155.2398 (264)
Space and water heating			5562.8068 (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			4948.1618 (272)
Primary energy kWh/m2/year			46.2618 (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 West
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

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

Solar shading

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

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

	Jun	Jul	Aug	
Solar gains	560	519	455	(P3)
Internal gains	503	482	492	
Total summer gains	1064	1002	947	(P5)
Summer gain/loss ratio	1.40	1.32	1.24	(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	18.20	20.02	19.95	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			