



SAP Report Submission for Building Regulations Compliance

Client: Highwood Construction Ltd

Project: 83 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 212				Issued on Date	02/03/2023
Assessment Reference	AB		Prop Type Ref	Type 4.2		
Property	83 Highwood Avenue, EASTLEIGH, SO50 9QY					
SAP Rating	88 B	DER	13.22	TER	16.96	
Environmental	89 B	% DER<TER	22.05			
CO ₂ Emissions (t/year)	1.05	DFEE	44.41	TFEE	50.47	
General Requirements Compliance	Pass	% DFEE<TFEE	12.02			
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)	16.96	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.22	kgCO ₂ /m ²	Pass
	-3.74 (-22.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.47	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	44.41	kWh/m ² /yr	
	-6.1 (-12.1%)	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	3.96 (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 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

3.96 (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

Air permeability

4.0

m³/m²h

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	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	85.21	kJ/m ² K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.20	9.00	105.46	93.33
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 frame with/without sheathing board	0.00	20.00	53.44

9.2 Internal Walls

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

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	23.93	23.93
Dormer Roof	External Flat Roof	Plasterboard, insulated flat roof	0.18	9.00	2.44	2.44
Skilling	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	
Rear Elevation	Window	[1] External Wall	North East	None	0.00					6.70	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Built)

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	9.43	0.300	Yes
Table K1 - Approved	E3 Sill	8.41	0.040	Yes
Table K1 - Approved	E4 Jamb	24.78	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/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.2900	
Layer 1	Brick, outer leaf				
	Main construction	100	0.7700	0.0000	82.81
	Main construction	100	0.9407	0.0000	17.19
Layer 2	Standard cavity				
	Main construction	50	0.0000	0.0000	100.00
	Corrections - Cavity Ventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 3	Breather membrane				
	Main construction	1	0.0000	0.0000	100.00
Layer 4	Orientated Strand Board				
	Main construction	9	0.1300	0.0692	100.00
Layer 5	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 6	Celotex GA4000				
	Main construction	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 7	Timber Frame Void				
	Main construction	20	0.1143	0.1750	92.17
	Main construction	20	0.1300	0.1538	7.83
	Corrections - Cavity Unventilated, Emissivity: Low				
	Emissivity (BR443)				
Layer 8	Polythene, 500 gauge				
	Main construction	1	0.0000	0.0000	100.00
Layer 9	Service Void				
	Main construction	25	0.0321	0.7800	89.63
	Main construction	25	0.1300	0.1923	10.37
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 10	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 11	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

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

Unheated space: None

Total thickness: 342 mm

U-value: 0.20 W/m² K

Kappa: n/a

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Building Elements

Wall Studwork

Wall Type: Timber framed Wall with I-beams

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Celotex GA4000				
	Main construction	100	0.0220	4.5455	92.17
	Main construction	100	0.1300	0.7692	7.83
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 2	Celotex GA4000				
	Main construction	50	0.0220	2.2727	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

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

Unheated space: None

Total thickness: 166 mm

U-value: 0.16 W/m² K

Kappa: n/a

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Building Elements

Floor Ground Floor - Stoneham - Ground Floor

Floor Type: Suspended Floor

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

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	Blockwork, dense				
	Main construction	100	1.5900	0.0629	82.95
	Main construction	100	2.2000	0.0455	17.05
Layer 2	Jablite Jabfloor (HP)				
	Main construction	150	0.0320	4.6875	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 5.153 m² K/W Lower limit = 5.152 m² K/W Average = 5.152 m² K/W

Total correction = 0.0083 m² K/W

U-value (unrounded) = 0.16 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.16 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS BUILT

Semi-Detached House, total floor area 107 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.96 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.22 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)44.4 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: 3.96 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESPl 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading:

Average

Windows facing North East: 6.70 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

Air permeability 4.0 m³/m²h

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	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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3509 (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) =		0.3246 (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	0.4138	0.4057	0.3976	0.3570	0.3489	0.3083	0.3083	0.3002	0.3246	0.3489	0.3651	0.3814 (22b)
Effective ac	0.5856	0.5823	0.5790	0.5637	0.5609	0.5475	0.5475	0.5451	0.5527	0.5609	0.5667	0.5727 (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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	12.1300	93.3300	0.2000	18.6660	9.0000	839.9700 (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) =	51.4171		(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) =		9114.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.2127 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1941 (36)
Total fabric heat loss						(33) + (36) =	68.6112 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.5623	50.2752	49.9938	48.6722	48.4249	47.2737	47.2737	47.0606	47.7171	48.4249	48.9251	49.4481 (38)
Average = Sum(39)m / 12 =	119.1735	118.8864	118.6050	117.2834	117.0361	115.8849	115.8849	115.6718	116.3283	117.0361	117.5363	118.0593 (39)
												117.2822 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1142	1.1115	1.1089	1.0965	1.0942	1.0834	1.0834	1.0814	1.0876	1.0942	1.0989	1.1038 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	139.7647	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.1579	24.1214	19.6169	14.8512	11.1015	9.3723	10.1271	13.1636	17.6682	22.4338	26.1836	27.9128	(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	440.2876	437.6951	421.3719	395.1632	368.3724	342.9911	326.8548	333.6645	347.4820	373.9207	404.1214	426.9386	(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)	
Southwest				4.6400	36.7938	0.6300		0.7000		0.7700	52.1753 (79)	
Solar gains	75.2783	135.9007	206.3285	289.8165	355.8032	366.9473	348.0679	296.7418	234.9100	155.6951	91.5636	63.5183 (83)
Total gains	515.5659	573.5958	627.7004	684.9797	724.1756	709.9384	674.9227	630.4062	582.3920	529.6158	495.6850	490.4569 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2444	21.2957	21.3462	21.5867	21.6323	21.8472	21.8472	21.8875	21.7639	21.6323	21.5403	21.4448
alpha	2.4163	2.4197	2.4231	2.4391	2.4422	2.4565	2.4565	2.4592	2.4509	2.4422	2.4360	2.4297
util living area	0.9714	0.9614	0.9430	0.9047	0.8359	0.7261	0.6060	0.6485	0.8133	0.9215	0.9612	0.9745 (86)
MIT	18.2316	18.4647	18.8993	19.5039	20.0951	20.5745	20.8102	20.7680	20.3821	19.6342	18.8362	18.1905 (87)
Th 2	19.9893	19.9914	19.9936	20.0037	20.0056	20.0144	20.0144	20.0160	20.0110	20.0056	20.0017	19.9978 (88)
util rest of house	0.9674	0.9560	0.9344	0.8889	0.8049	0.6656	0.5087	0.5561	0.7665	0.9055	0.9549	0.9710 (89)
MIT 2	17.4410	17.6735	18.1052	18.7060	19.2766	19.7230	19.9159	19.8886	19.5580	18.8419	18.0514	17.4059 (90)
Living area fraction	17.5511	17.7837	18.2158	18.8172	19.3907	19.8416	20.0405	20.0111	fLA = Living area / (4) =	18.9523	18.1607	0.1393 (91)
MIT	17.5511	17.7837	18.2158	18.8172	19.3907	19.8416	20.0405	20.0111	19.6728	18.9523	18.1607	17.5152 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.4011	17.6337	18.0658	18.6672	19.2407	19.6916	19.8905	19.8611	19.5228	18.8023	18.0107	17.3652 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9529	0.9384	0.9124	0.8617	0.7758	0.6425	0.4948	0.5393	0.7380	0.8796	0.9370	0.9577	(94)
Useful gains	491.2738	538.2839	572.7017	590.2565	561.8094	456.1304	333.9307	339.9552	429.8102	465.8242	464.4774	469.6955	(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													
	1561.3063	1513.8626	1371.7655	1145.5247	882.5290	590.0437	381.3160	400.3479	630.8271	959.9611	1282.4041	1554.2725	(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													
	796.1041	655.5889	594.5035	399.7931	238.6154	0.0000	0.0000	0.0000	0.0000	367.6378	588.9073	806.9253	(98)
Space heating												4448.0754	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating per m2 (98) / (4) = 41.5863 (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													4915.0004 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	796.1041	655.5889	594.5035	399.7931	238.6154	0.0000	0.0000	0.0000	0.0000	367.6378	588.9073	806.9253	(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)	879.6731	724.4076	656.9099	441.7603	263.6634	0.0000	0.0000	0.0000	0.0000	406.2297	650.7262	891.6302	(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	89.8972	89.8659	89.7945	89.6356	89.3010	87.3000	87.3000	87.3000	87.3000	89.5572	89.7968	87.3000	(216)
Fuel for water heating, kWh/month	198.2673	173.9043	180.6375	159.2304	154.4447	137.9687	129.4752	146.2628	147.3258	165.4086	178.1775	192.4496	(219)
Water heating fuel used												1963.5525	(219)
Annual totals kWh/year													
Space heating fuel - main system												4915.0004	(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)												479.6179	(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												6740.4297	(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	4915.0004	0.2160	1061.6401 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1963.5525	0.2160	424.1273 (264)
Space and water heating			1485.7674 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	479.6179	0.5190	248.9217 (268)
Energy saving/generation technologies			
PV Unit	-692.7410	0.5190	-359.5326 (269)
Total CO2, kg/year			1414.0815 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.2200 (273)

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

DER		13.2200	ZC1
Total Floor Area		106.9600	
Assumed number of occupants		2.7953	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		14.7986	ZC2
CO2 emissions from cooking, equation (L16)		1.7398	ZC3
Total CO2 emissions		29.7584	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		29.7584	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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1300	5.3469		(28a)
External Wall	105.4600	12.1300	93.3300	0.1800	16.7994		(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) =	47.8360		(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)							10.7704 (36)
Total fabric heat loss						(33) + (36) =	58.6064 (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	111.5222	111.1438	110.7728	109.0304	108.7044	107.1868	107.1868	106.9057	107.7713	108.7044	109.3639	110.0533 (39)
Average = Sum(39)m / 12 =												109.0288 (39)
HLP	1.0427	1.0391	1.0356	1.0194	1.0163	1.0021	1.0021	0.9995	1.0076	1.0163	1.0225	1.0289 (40)
HLP (average)												1.0193 (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	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)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)													
Total per year (kWh/year) = Sum(64)m = 2166.1923 (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	27.1579	24.1214	19.6169	14.8512	11.1015	9.3723	10.1271	13.1636	17.6682	22.4338	26.1836	27.9128	(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	452.6560	450.0678	433.7532	407.3142	379.8460	353.7895	337.6616	345.1459	359.6446	386.3134	416.5003	439.3112	(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)
Southwest			4.6400			36.7938	0.6300		0.7000		0.7700		52.1753 (79)
Solar gains	75.2783	135.9007	206.3285	289.8165	355.8032	366.9473	348.0679	296.7418	234.9100	155.6951	91.5636	63.5183 (83)	
Total gains	527.9344	585.9685	640.0817	697.1306	735.6492	720.7368	685.7295	641.8876	594.5546	542.0085	508.0638	502.8295 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	66.6036	66.8304	67.0542	68.1258	68.3301	69.2975	69.2975	69.4797	68.9217	68.3301	67.9180	67.4925		
alpha	5.4402	5.4554	5.4703	5.5417	5.5553	5.6198	5.6198	5.6320	5.5948	5.5553	5.5279	5.4995		
util living area	0.9992	0.9985	0.9961	0.9860	0.9468	0.8272	0.6592	0.7179	0.9257	0.9912	0.9984	0.9994	(86)	
MIT	19.8045	19.9207	20.1314	20.4317	20.7170	20.9190	20.9823	20.9721	20.8258	20.4660	20.0895	19.7912	(87)	
Th 2	20.0479	20.0509	20.0537	20.0672	20.0698	20.0816	20.0816	20.0838	20.0770	20.0698	20.0646	20.0593	(88)	
util rest of house	0.9990	0.9979	0.9946	0.9800	0.9218	0.7508	0.5359	0.5978	0.8802	0.9864	0.9978	0.9992	(89)	
MIT 2	18.4361	18.6082	18.9179	19.3633	19.7643	20.0202	20.0741	20.0704	19.9175	19.4176	18.8653	18.4248	(90)	
Living area fraction	18.6267	18.7910	19.0870	19.5121	19.8970	20.1454	20.2006	20.1960	20.0440	19.5636	19.0358	18.6152	(92)	
Temperature adjustment	18.6267	18.7910	19.0870	19.5121	19.8970	20.1454	20.2006	20.1960	20.0440	19.5636	19.0358	18.6152	(93)	
adjusted MIT	18.6267	18.7910	19.0870	19.5121	19.8970	20.1454	20.2006	20.1960	20.0440	19.5636	19.0358	18.6152	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9984	0.9969	0.9923	0.9751	0.9159	0.7568	0.5529	0.6138	0.8781	0.9826	0.9967	0.9988	(94)
Ext temp.	527.0786	584.1230	635.1546	679.7786	673.7977	545.4553	379.1121	393.9647	522.0921	532.5582	506.3759	502.2103	(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	1597.7483	1543.9001	1394.2954	1157.0430	891.0542	594.3912	385.9360	405.8134	640.5937	974.3867	1305.3506	1586.4369	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	796.5782	644.9702	564.8007	343.6303	161.6388	0.0000	0.0000	0.0000	0.0000	328.7203	575.2618	806.6646	(98)
												4222.2651	(98)
												39.4752	(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													4520.6264 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	796.5782	644.9702	564.8007	343.6303	161.6388	0.0000	0.0000	0.0000	0.0000	328.7203	575.2618	806.6646	(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)	852.8675	690.5463	604.7117	367.9126	173.0608	0.0000	0.0000	0.0000	0.0000	351.9490	615.9120	863.6666	(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	88.0459	87.8892	87.5311	86.6834	84.8942	80.3000	80.3000	80.3000	80.3000	86.4826	87.6036	88.1120	(216)
Fuel for water heating, kWh/month	244.2422	215.6560	227.4043	205.0243	202.6830	188.7251	180.8130	201.5642	203.7902	213.9343	223.3341	238.1831	(219)
Water heating fuel used												2545.3539	(219)
Annual totals kWh/year													
Space heating fuel - main system												4520.6264	(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)												479.6179	(232)
Total delivered energy for all uses												7620.5982	(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	4520.6264	0.2160	976.4553 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2545.3539	0.2160	549.7964 (264)
Space and water heating			1526.2517 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	479.6179	0.5190	248.9217 (268)
Total CO2, kg/m2/year			1814.0984 (272)
Emissions per m2 for space and water heating			14.2694 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3272 (272b)
Emissions per m2 for pumps and fans			0.3639 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2694 * 1.00) + 2.3272 + 0.3639, rounded to 2 d.p.			16.9600 (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	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3509 (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) =				0.3246 (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	0.4138	0.4057	0.3976	0.3570	0.3489	0.3083	0.3083	0.3002	0.3246	0.3489	0.3651	0.3814 (22b)
Effective ac	0.5856	0.5823	0.5790	0.5637	0.5609	0.5475	0.5475	0.5451	0.5527	0.5609	0.5667	0.5727 (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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	12.1300	93.3300	0.2000	18.6660	9.0000	839.9700 (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) =	51.4171		(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) =			8521.8800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							79.6735 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1941 (36)
Total fabric heat loss						(33) + (36) =	68.6112 (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	50.5623	50.2752	49.9938	48.6722	48.4249	47.2737	47.2737	47.0606	47.7171	48.4249	48.9251	49.4481 (38)
Heat transfer coeff	119.1735	118.8864	118.6050	117.2834	117.0361	115.8849	115.8849	115.6718	116.3283	117.0361	117.5363	118.0593 (39)
Average = Sum(39)m / 12 =												117.2822 (39)
HLP	1.1142	1.1115	1.1089	1.0965	1.0942	1.0834	1.0834	1.0814	1.0876	1.0942	1.0989	1.1038 (40)
HLP (average)												1.0965 (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	27.1579	24.1214	19.6169	14.8512	11.1015	9.3723	10.1271	13.1636	17.6682	22.4338	26.1836	27.9128 (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	406.0672	404.3175	389.7444	365.9165	340.6743	317.4710	303.1826	307.6210	320.5933	344.5680	371.9881	393.5575 (73)

6. Solar gains

[Jan]												Gains
			Area m2			Solar flux Table 6a W/m2	g		FF		Access factor Table 6d	W
							Specific data or Table 6b		Specific data or Table 6c			
Northeast			6.7000			11.2829	0.6300		0.7000		0.7700	23.1030 (75)
Southwest			4.6400			36.7938	0.6300		0.7000		0.7700	52.1753 (79)
Solar gains	75.2783	135.9007	206.3285	289.8165	355.8032	366.9473	348.0679	296.7418	234.9100	155.6951	91.5636	63.5183 (83)
Total gains	481.3455	540.2182	596.0729	655.7329	696.4775	684.4183	651.2505	604.3627	555.5033	500.2631	463.5516	457.0757 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	19.8634	19.9113	19.9586	20.1835	20.2261	20.4271	20.4271	20.4647	20.3492	20.2261	20.1401	20.0508
alpha	2.3242	2.3274	2.3306	2.3456	2.3484	2.3618	2.3618	2.3643	2.3566	2.3484	2.3427	2.3367
util living area	0.9718	0.9616	0.9430	0.9049	0.8373	0.7302	0.6129	0.6569	0.8176	0.9231	0.9620	0.9749 (86)
MIT	18.0612	18.3052	18.7606	19.3946	20.0168	20.5273	20.7836	20.7357	20.3201	19.5301	18.6930	18.0192 (87)
Th 2	19.9893	19.9914	19.9936	20.0037	20.0056	20.0144	20.0144	20.0160	20.0110	20.0056	20.0017	19.9978 (88)
util rest of house	0.9680	0.9564	0.9348	0.8896	0.8073	0.6715	0.5171	0.5664	0.7728	0.9078	0.9559	0.9715 (89)
MIT 2	17.2795	17.5229	17.9756	18.6060	19.2082	19.6863	19.8993	19.8674	19.5069	18.7473	17.9172	17.2433 (90)
Living area fraction	17.3884	17.6318	18.0849	18.7159	19.3208	19.8034	20.0225	19.9884	19.6202	18.8563	18.0253	17.3514 (91)
MIT	17.3884	17.6318	18.0849	18.7159	19.3208	19.8034	20.0225	19.9884	19.6202	18.8563	18.0253	17.3514 (92)
Temperature adjustment												0.0000
adjusted MIT	17.3884	17.6318	18.0849	18.7159	19.3208	19.8034	20.0225	19.9884	19.6202	18.8563	18.0253	17.3514 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9541	0.9396	0.9138	0.8644	0.7823	0.6569	0.5180	0.5635	0.7511	0.8845	0.9393	0.9588 (94)
Ext temp.	459.2540	507.5778	544.6995	566.8260	544.8753	449.6063	337.3600	340.5410	417.2389	442.4752	435.3928	438.2408 (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	1559.7873	1513.6437	1374.0319	1151.2368	891.9140	602.9977	396.6127	415.0739	642.1566	966.2907	1284.1158	1552.6405 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	818.7967	676.0763	617.0233	420.7758	258.1968	0.0000	0.0000	0.0000	0.0000	389.7187	611.0806	829.1134 (98)
Space heating per m ²	(98) / (4) = 43.2010 (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	1089.3184	857.5485	879.1054	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6373	0.7073	0.6765	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	694.2096	606.5066	594.7443	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	910.2024	869.1745	816.8108	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	155.5148	195.4249	165.2175	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			516.1572	(104)
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	(105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.8787	48.8562	41.3044	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling													
Space cooling per m2												129.0393	(107)
Energy for space heating												1.2064	(108)
Energy for space cooling												43.2010	(99)
Total												1.2064	(108)
Dwelling Fabric Energy Efficiency (DFEE)												44.4074	(109)
												44.4	(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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1300	5.3469		(28a)
External Wall	105.4600	12.1300	93.3300	0.1800	16.7994		(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) =	47.8360		(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)							10.7704 (36)
Total fabric heat loss						(33) + (36) =	58.6064 (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	111.5222	111.1438	110.7728	109.0304	108.7044	107.1868	107.1868	106.9057	107.7713	108.7044	109.3639	110.0533 (39)
Average = Sum(39)m / 12 =												109.0288 (39)
HLP	1.0427	1.0391	1.0356	1.0194	1.0163	1.0021	1.0021	0.9995	1.0076	1.0163	1.0225	1.0289 (40)
HLP (average)												1.0193 (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	(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	(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	(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	27.1579	24.1214	19.6169	14.8512	11.1015	9.3723	10.1271	13.1636	17.6682	22.4338	26.1836	27.9128	(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	406.0672	404.3175	389.7444	365.9165	340.6743	317.4710	303.1826	307.6210	320.5933	344.5680	371.9881	393.5575	(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)				
Southwest			4.6400	36.7938	0.6300	0.7000	0.7700	52.1753 (79)				
Solar gains	75.2783	135.9007	206.3285	289.8165	355.8032	366.9473	348.0679	296.7418	234.9100	155.6951	91.5636	63.5183 (83)
Total gains	481.3455	540.2182	596.0729	655.7329	696.4775	684.4183	651.2505	604.3627	555.5033	500.2631	463.5516	457.0757 (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	66.6036	66.8304	67.0542	68.1258	68.3301	69.2975	69.2975	69.4797	68.9217	68.3301	67.9180	67.4925	
alpha	5.4402	5.4554	5.4703	5.5417	5.5553	5.6198	5.6198	5.6320	5.5948	5.5553	5.5279	5.4995	
util living area	0.9995	0.9990	0.9972	0.9894	0.9570	0.8499	0.6872	0.7500	0.9421	0.9940	0.9990	0.9997	(86)
MIT	19.7630	19.8800	20.0927	20.3970	20.6900	20.9059	20.9783	20.9652	20.8014	20.4301	20.0498	19.7502	(87)
Th 2	20.0479	20.0509	20.0537	20.0672	20.0698	20.0816	20.0816	20.0838	20.0770	20.0698	20.0646	20.0593	(88)
util rest of house	0.9994	0.9986	0.9961	0.9848	0.9357	0.7774	0.5620	0.6300	0.9036	0.9906	0.9986	0.9995	(89)
MIT 2	18.9059	19.0253	19.2399	19.5529	19.8375	20.0315	20.0751	20.0720	19.9488	19.5893	19.2062	18.9024	(90)
Living area fraction													(91)
MIT	19.0253	19.1443	19.3587	19.6705	19.9562	20.1533	20.2009	20.1964	20.0676	19.7064	19.3237	19.0205	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0253	19.1443	19.3587	19.6705	19.9562	20.1533	20.2009	20.1964	20.0676	19.7064	19.3237	19.0205	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	480.9165	539.2083	593.1091	644.0082	649.4122	536.5615	377.3910	390.6143	501.6564	494.6153	462.6828	456.7745	(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	1642.1995	1583.1701	1424.3897	1174.3110	897.4877	595.2419	385.9723	405.8574	643.1351	989.9096	1336.8334	1631.0479	(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	863.9946	701.5424	618.4728	381.8180	184.5682	0.0000	0.0000	0.0000	0.0000	368.4989	629.3884	873.6594	(98)
Space heating												4621.9426	(98)
Space heating per m2												43.2119	(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	1007.5555	793.1820	812.4835	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8027	0.8849	0.8515	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	808.7376	701.8948	691.7985	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	910.2024	869.1745	816.8108	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	73.0547	124.4561	93.0091	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												290.5199 (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	18.2637	31.1140	23.2523	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												72.6300 (107)
Space cooling per m2												0.6790 (108)
Energy for space heating												43.2119 (99)
Energy for space cooling												0.6790 (108)
Total												43.8909 (109)
Target Fabric Energy Efficiency (TFEE)												50.5 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3509 (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) =		0.3246 (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												
Effective ac	0.3570	0.3327	0.3327	0.3165	0.3165	0.3002	0.3002	0.2840	0.2840	0.3083	0.3002	0.3165 (22b)
	0.5637	0.5553	0.5553	0.5501	0.5501	0.5451	0.5451	0.5403	0.5403	0.5475	0.5451	0.5501 (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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	12.1300	93.3300	0.2000	18.6660	9.0000	839.9700 (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) =	51.4171		(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) =		9114.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.2127 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1941 (36)
Total fabric heat loss						(33) + (36) =	68.6112 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.6722	Feb 47.9474	Mar 47.9474	Apr 47.4926	May 47.4926	Jun 47.0606	Jul 47.0606	Aug 46.6513	Sep 46.6513	Oct 47.2737	Nov 47.0606	Dec 47.4926 (38)
Heat transfer coeff	117.2834	116.5586	116.5586	116.1038	116.1038	115.6718	115.6718	115.2625	115.2625	115.8849	115.6718	116.1038 (39)
Average = Sum(39)m / 12 =												116.0114 (39)
HLP	Jan 1.0965	Feb 1.0897	Mar 1.0897	Apr 1.0855	May 1.0855	Jun 1.0814	Jul 1.0814	Aug 1.0776	Sep 1.0776	Oct 1.0834	Nov 1.0814	Dec 1.0855 (40)
HLP (average)												1.0846 (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	67.8949	60.3036	49.0422	37.1281	27.7537	23.4308	25.3178	32.9091	44.1705	56.0846	65.4590	69.7819 (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	658.1315	652.3496	625.8291	585.1480	543.4873	506.8231	486.0141	496.0133	520.0280	560.9391	606.0097	640.1098 (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)	
Southwest					4.6400	45.1778	0.6300	0.7000	0.7700		64.0642 (79)	
Solar gains	93.9954	145.0495	223.5398	317.9103	370.0852	418.6672	383.0816	340.2784	267.5656	177.4686	114.0907	74.9965 (83)
Total gains	752.1269	797.3991	849.3689	903.0583	913.5726	925.4902	869.0957	836.2917	787.5936	738.4077	720.1004	715.1064 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.5867	21.7210	21.7210	21.8060	21.8060	21.8875	21.8875	21.9652	21.9652	21.8472	21.8875	21.8060
alpha	2.4391	2.4481	2.4481	2.4537	2.4537	2.4592	2.4592	2.4643	2.4643	2.4565	2.4592	2.4537
util living area	0.9293	0.9158	0.8830	0.8207	0.7119	0.5407	0.4046	0.4168	0.6445	0.8206	0.9021	0.9347 (86)
MIT	18.8840	19.0677	19.4765	19.9926	20.4984	20.8315	20.9434	20.9400	20.7183	20.1779	19.4792	18.8739 (87)
Th 2	20.0037	20.0092	20.0092	20.0127	20.0127	20.0160	20.0160	20.0192	20.0192	20.0144	20.0160	20.0127 (88)
util rest of house	0.9199	0.9046	0.8666	0.7936	0.6632	0.4603	0.2962	0.3063	0.5719	0.7869	0.8868	0.9259 (89)
MIT 2	18.0932	18.2768	18.6763	19.1748	19.6429	19.9217	19.9964	19.9981	19.8428	19.3603	18.6888	18.0902 (90)
Living area fraction									fLA = Living area / (4) =			0.1393 (91)
MIT	18.2033	18.3870	18.7878	19.2887	19.7621	20.0484	20.1283	20.1293	19.9648	19.4742	18.7989	18.1994 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0533	18.2370	18.6378	19.1387	19.6121	19.8984	19.9783	19.9793	19.8148	19.3242	18.6489	18.0494 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8960	0.8790	0.8384	0.7652	0.6407	0.4498	0.2918	0.3015	0.5548	0.7583	0.8598	0.9029 (94)
Ext temp.	673.8718	700.8950	712.1456	691.0267	585.3117	416.2868	253.6134	252.1420	436.9456	559.9525	619.1403	645.6552 (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	1484.0239	1437.9837	1286.5487	1061.0402	756.0801	462.5027	263.5348	262.7206	520.3833	848.7647	1185.5075	1457.0296 (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)
Month fracti	602.7531	495.3236	427.3559	266.4097	127.0517	0.0000	0.0000	0.0000	0.0000	214.8763	407.7844	603.6625 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating	3145.2172 (98)
RHI space heating demand	3145 (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					3.9600
Infiltration rate					0.3509 (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) =		0.3246 (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	0.4138	0.4057	0.3976	0.3570	0.3489	0.3083	0.3083	0.3002	0.3246	0.3489	0.3651	0.3814 (22b)
Effective ac	0.5856	0.5823	0.5790	0.5637	0.5609	0.5475	0.5475	0.5451	0.5527	0.5609	0.5667	0.5727 (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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	12.1300	93.3300	0.2000	18.6660	9.0000	839.9700 (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) =	51.4171		(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) =		9114.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.2127 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1941 (36)
Total fabric heat loss						(33) + (36) =	68.6112 (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	50.5623	50.2752	49.9938	48.6722	48.4249	47.2737	47.2737	47.0606	47.7171	48.4249	48.9251	49.4481 (38)
Heat transfer coeff	119.1735	118.8864	118.6050	117.2834	117.0361	115.8849	115.8849	115.6718	116.3283	117.0361	117.5363	118.0593 (39)
Average = Sum(39)m / 12 =												117.2822 (39)
HLP	1.1142	1.1115	1.1089	1.0965	1.0942	1.0834	1.0834	1.0814	1.0876	1.0942	1.0989	1.1038 (40)
HLP (average)												1.0965 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Average daily hot water use (litres/day)												100.5882 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	67.8949	60.3036	49.0422	37.1281	27.7537	23.4308	25.3178	32.9091	44.1705	56.0846	65.4590	69.7819 (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	658.1315	652.3496	625.8291	585.1480	543.4873	506.8231	486.0141	496.0133	520.0280	560.9391	606.0097	640.1098 (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)
Southwest				4.6400	36.7938	0.6300	0.7000			0.7700			52.1753 (79)

Solar gains	75.2783	135.9007	206.3285	289.8165	355.8032	366.9473	348.0679	296.7418	234.9100	155.6951	91.5636	63.5183 (83)	
Total gains	733.4099	788.2503	832.1577	874.9645	899.2905	873.7704	834.0820	792.7550	754.9380	716.6342	697.5733	703.6281 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2444	21.2957	21.3462	21.5867	21.6323	21.8472	21.8472	21.8875	21.7639	21.6323	21.5403	21.4448
alpha	2.4163	2.4197	2.4231	2.4391	2.4422	2.4565	2.4565	2.4592	2.4509	2.4422	2.4360	2.4297
util living area	0.9415	0.9278	0.9030	0.8546	0.7736	0.6505	0.5246	0.5605	0.7317	0.8655	0.9238	0.9464 (86)
MIT	18.5842	18.7993	19.1965	19.7435	20.2644	20.6740	20.8639	20.8349	20.5299	19.8819	19.1502	18.5414 (87)
Th 2	19.9893	19.9914	19.9936	20.0037	20.0056	20.0144	20.0144	20.0160	20.0110	20.0056	20.0017	19.9978 (88)
util rest of house	0.9340	0.9185	0.8898	0.8331	0.7365	0.5864	0.4312	0.4695	0.6764	0.8415	0.9125	0.9396 (89)
MIT 2	17.7871	18.0002	18.3920	18.9307	19.4255	19.7980	19.9466	19.9293	19.6786	19.0732	18.3565	17.7509 (90)
Living area fraction	17.8982	18.1115	18.5040	19.0439	19.5423	19.9200	20.0744	20.0555	fLA = Living area / (4) =	19.7972	19.1858	18.4671
MIT	17.8982	18.1115	18.5040	19.0439	19.5423	19.9200	20.0744	20.0555	19.7972	19.1858	18.4671	17.8610 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7482	17.9615	18.3540	18.8939	19.3923	19.7700	19.9244	19.9055	19.6472	19.0358	18.3171	17.7110 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9119	0.8941	0.8627	0.8041	0.7099	0.5686	0.4218	0.4582	0.6527	0.8124	0.8875	0.9186 (94)
Ext temp.	668.7730	704.7975	717.8747	703.5360	638.3835	496.8416	351.8482	363.2370	492.7295	582.1668	619.0959	646.3345 (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	1602.6633	1552.8406	1405.9486	1172.1198	900.2805	599.1287	385.2451	405.4834	645.2935	987.2985	1318.4175	1595.0995 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	694.8144	569.8849	511.9270	337.3804	194.8514	0.0000	0.0000	0.0000	0.0000	301.4179	503.5115	705.8811 (98)
	3819.6688 (98)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating per m2 (98) / (4) = 35.7112 (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													4220.6285 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	694.8144	569.8849	511.9270	337.3804	194.8514	0.0000	0.0000	0.0000	0.0000	301.4179	503.5115	705.8811	(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)	767.7507	629.7071	565.6652	372.7960	215.3054	0.0000	0.0000	0.0000	0.0000	333.0585	556.3663	779.9792	(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	89.8278	89.7917	89.7088	89.5245	89.1457	87.3000	87.3000	87.3000	87.3000	89.4199	89.7071	87.3000	(216)
Fuel for water heating, kWh/month	198.4205	174.0481	180.8100	159.4281	154.7138	137.9687	129.4752	146.2628	147.3258	165.6625	178.3557	192.5919	(219)
Water heating fuel used												1965.0631	(219)
Annual totals kWh/year													
Space heating fuel - main system												4220.6285	(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)												479.6179	(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												6047.5685	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4220.6285	3.4800	146.8779 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1965.0631	3.4800	68.3842 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	479.6179	13.1900	63.2616 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-692.7410	13.1900	-91.3725 (252)
Total energy cost			317.0436 (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] =	0.8763 (257)
SAP value	87.7760	
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	4220.6285	0.2160	911.6558 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1965.0631	0.2160	424.4536 (264)
Space and water heating			1336.1094 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	479.6179	0.5190	248.9217 (268)
Energy saving/generation technologies			
PV Unit	-692.7410	0.5190	-359.5326 (269)
Total kg/year			1264.4235 (272)
CO2 emissions per m2			11.8200 (273)
EI value			88.8502
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8885 = 3.917$, stars = 4
Water heating environmental impact	$0.216 / 0.8885 = 0.2431$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3509 (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) =				0.3246 (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	0.3570	0.3327	0.3327	0.3165	0.3165	0.3002	0.3002	0.2840	0.2840	0.3083	0.3002	0.3165 (22b)
Effective ac	0.5637	0.5553	0.5553	0.5501	0.5501	0.5451	0.5451	0.5403	0.5403	0.5475	0.5451	0.5501 (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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	12.1300	93.3300	0.2000	18.6660	9.0000	839.9700 (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) =	51.4171		(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) =		9114.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.2127 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1941 (36)
Total fabric heat loss						(33) + (36) =	68.6112 (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	48.6722	47.9474	47.9474	47.4926	47.4926	47.0606	47.0606	46.6513	46.6513	47.2737	47.0606	47.4926 (38)
Heat transfer coeff	117.2834	116.5586	116.5586	116.1038	116.1038	115.6718	115.6718	115.2625	115.2625	115.8849	115.6718	116.1038 (39)
Average = Sum(39)m / 12 =												116.0114 (39)
HLP	1.0965	1.0897	1.0897	1.0855	1.0855	1.0814	1.0814	1.0776	1.0776	1.0834	1.0814	1.0855 (40)
HLP (average)												1.0846 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Average daily hot water use (litres/day)												100.5882 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy content (annual)	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum (45)m =											1582.6444 (45)
Water storage loss:	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	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	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	67.8949	60.3036	49.0422	37.1281	27.7537	23.4308	25.3178	32.9091	44.1705	56.0846	65.4590	69.7819 (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	658.1315	652.3496	625.8291	585.1480	543.4873	506.8231	486.0141	496.0133	520.0280	560.9391	606.0097	640.1098 (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)	
Southwest				4.6400	45.1778	0.6300		0.7000		0.7700		64.0642 (79)	

Solar gains	93.9954	145.0495	223.5398	317.9103	370.0852	418.6672	383.0816	340.2784	267.5656	177.4686	114.0907	74.9965 (83)	
Total gains	752.1269	797.3991	849.3689	903.0583	913.5726	925.4902	869.0957	836.2917	787.5936	738.4077	720.1004	715.1064 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.5867	21.7210	21.7210	21.8060	21.8060	21.8875	21.8875	21.9652	21.9652	21.8472	21.8875	21.8060
alpha	2.4391	2.4481	2.4481	2.4537	2.4537	2.4592	2.4592	2.4643	2.4643	2.4565	2.4592	2.4537
util living area	0.9293	0.9158	0.8830	0.8207	0.7119	0.5407	0.4046	0.4168	0.6445	0.8206	0.9021	0.9347 (86)
MIT	18.8840	19.0677	19.4765	19.9926	20.4984	20.8315	20.9434	20.9400	20.7183	20.1779	19.4792	18.8739 (87)
Th 2	20.0037	20.0092	20.0092	20.0127	20.0127	20.0160	20.0160	20.0192	20.0192	20.0144	20.0160	20.0127 (88)
util rest of house	0.9199	0.9046	0.8666	0.7936	0.6632	0.4603	0.2962	0.3063	0.5719	0.7869	0.8868	0.9259 (89)
MIT 2	18.0932	18.2768	18.6763	19.1748	19.6429	19.9217	19.9964	19.9981	19.8428	19.3603	18.6888	18.0902 (90)
Living area fraction									fLA = Living area / (4) =			0.1393 (91)
MIT	18.2033	18.3870	18.7878	19.2887	19.7621	20.0484	20.1283	20.1293	19.9648	19.4742	18.7989	18.1994 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0533	18.2370	18.6378	19.1387	19.6121	19.8984	19.9783	19.9793	19.8148	19.3242	18.6489	18.0494 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8960	0.8790	0.8384	0.7652	0.6407	0.4498	0.2918	0.3015	0.5548	0.7583	0.8598	0.9029 (94)
Useful gains	673.8718	700.8950	712.1456	691.0267	585.3117	416.2868	253.6134	252.1420	436.9456	559.9525	619.1403	645.6552 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W												
	1484.0239	1437.9837	1286.5487	1061.0402	756.0801	462.5027	263.5348	262.7206	520.3833	848.7647	1185.5075	1457.0296 (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												
	602.7531	495.3236	427.3559	266.4097	127.0517	0.0000	0.0000	0.0000	0.0000	214.8763	407.7844	603.6625 (98)
Space heating												3145.2172 (98)

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Space heating per m2 (98) / (4) = 29.4055 (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													3475.3781 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.7531	495.3236	427.3559	266.4097	127.0517	0.0000	0.0000	0.0000	0.0000	214.8763	407.7844	603.6625	(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)	666.0256	547.3189	472.2165	294.3754	140.3886	0.0000	0.0000	0.0000	0.0000	237.4323	450.5905	667.0304	(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	89.7492	89.7113	89.5964	89.3574	88.8056	87.3000	87.3000	87.3000	87.3000	89.1663	89.5748	87.3000	(216)
Fuel for water heating, kWh/month	198.5942	174.2040	181.0367	159.7262	155.3063	137.9687	129.4752	146.2628	147.3258	166.1338	178.6191	192.7735	(219)
Water heating fuel used												1967.4264	(219)
Annual totals kWh/year													
Space heating fuel - main system												3475.3781	(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)												479.6179	(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												5203.0075	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3475.3781	9.7400	338.5018	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1967.4264	9.7400	191.6273	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Energy for lighting	479.6179	36.8500	176.7392	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-794.4149	36.8500	-292.7419	(252)
Total energy cost			545.7640	(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	3475.3781	0.2160	750.6817	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1967.4264	0.2160	424.9641	(264)
Space and water heating			1175.6458	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	479.6179	0.5190	248.9217	(268)
Energy saving/generation technologies				
PV Unit	-794.4149	0.5190	-412.3013	(269)
Total kg/year			1051.1911	(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	3475.3781	1.2200	4239.9613	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1967.4264	1.2200	2400.2602	(264)
Space and water heating			6640.2214	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	479.6179	3.0700	1472.4268	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-794.4149	3.0700	-2438.8536 (269)
Primary energy kWh/year			5904.0447 (272)
Primary energy kWh/m ² /year			55.1986 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 88
Current environmental impact rating:	B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 81	-194 kg (18.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£81 1.82 kg/m ²	B 89	B 91
Total Savings	£81 1.82 kg/m ²		

Potential energy efficiency rating:	B 89
Potential environmental impact rating:	B 91

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	£204	£223	-£18
Mains gas	£634	£535	£99
Space heating	£470	£470	£0
Water heating	£192	£111	£81
Lighting	£177	£177	£0
Generated (PV)	-£293	-£293	£0
Total cost of fuels	£545	£465	£81
Total cost of uses	£546	£465	£81
Delivered energy	49 kWh/m ²	40 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	1.1 tonnes	0.9 tonnes	0.2 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	55 kWh/m ²	45 kWh/m ²	10 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3509 (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) =		0.3246 (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	0.4138	0.4057	0.3976	0.3570	0.3489	0.3083	0.3083	0.3002	0.3246	0.3489	0.3651	0.3814 (22b)
Effective ac	0.5856	0.5823	0.5790	0.5637	0.5609	0.5475	0.5475	0.5451	0.5527	0.5609	0.5667	0.5727 (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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	12.1300	93.3300	0.2000	18.6660	9.0000	839.9700 (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) =	51.4171		(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) =		9114.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							85.2127 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1941 (36)
Total fabric heat loss						(33) + (36) =	68.6112 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	50.5623	50.2752	49.9938	48.6722	48.4249	47.2737	47.2737	47.0606	47.7171	48.4249	48.9251	49.4481 (38)
Average = Sum(39)m / 12 =	119.1735	118.8864	118.6050	117.2834	117.0361	115.8849	115.8849	115.6718	116.3283	117.0361	117.5363	118.0593 (39)
												117.2822 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1142	1.1115	1.1089	1.0965	1.0942	1.0834	1.0834	1.0814	1.0876	1.0942	1.0989	1.1038 (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)
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	Total = Sum(45)m = 1582.6444 (45)											
	(46)m = 0.15 x (45)m											
Water storage loss:	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (62)
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	67.8949	60.3036	49.0422	37.1281	27.7537	23.4308	25.3178	32.9091	44.1705	56.0846	65.4590	69.7819 (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	658.1315	652.3496	625.8291	585.1480	543.4873	506.8231	486.0141	496.0133	520.0280	560.9391	606.0097	640.1098 (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)
Southwest				4.6400	36.7938	0.6300		0.7000		0.7700			52.1753 (79)

Solar gains	75.2783	135.9007	206.3285	289.8165	355.8032	366.9473	348.0679	296.7418	234.9100	155.6951	91.5636		63.5183 (83)
Total gains	733.4099	788.2503	832.1577	874.9645	899.2905	873.7704	834.0820	792.7550	754.9380	716.6342	697.5733		703.6281 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.2444	21.2957	21.3462	21.5867	21.6323	21.8472	21.8472	21.8875	21.7639	21.6323	21.5403	21.4448
alpha	2.4163	2.4197	2.4231	2.4391	2.4422	2.4565	2.4565	2.4592	2.4509	2.4422	2.4360	2.4297
util living area	0.9415	0.9278	0.9030	0.8546	0.7736	0.6505	0.5246	0.5605	0.7317	0.8655	0.9238	0.9464 (86)
MIT	18.5842	18.7993	19.1965	19.7435	20.2644	20.6740	20.8639	20.8349	20.5299	19.8819	19.1502	18.5414 (87)
Th 2	19.9893	19.9914	19.9936	20.0037	20.0056	20.0144	20.0144	20.0160	20.0110	20.0056	20.0017	19.9978 (88)
util rest of house	0.9340	0.9185	0.8898	0.8331	0.7365	0.5864	0.4312	0.4695	0.6764	0.8415	0.9125	0.9396 (89)
MIT 2	17.7871	18.0002	18.3920	18.9307	19.4255	19.7980	19.9466	19.9293	19.6786	19.0732	18.3565	17.7509 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											
MIT	17.8982	18.1115	18.5040	19.0439	19.5423	19.9200	20.0744	20.0555	19.7972	19.1858	18.4671	17.8610 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Temperature adjustment
adjusted MIT 17.7482 17.9615 18.3540 18.8939 19.3923 19.7700 19.9244 19.9055 19.6472 19.0358 18.3171 -0.1500
17.7110 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9119	0.8941	0.8627	0.8041	0.7099	0.5686	0.4218	0.4582	0.6527	0.8124	0.8875	0.9186	(94)
Useful gains	668.7730	704.7975	717.8747	703.5360	638.3835	496.8416	351.8482	363.2370	492.7295	582.1668	619.0959	646.3345	(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	1602.6633	1552.8406	1405.9486	1172.1198	900.2805	599.1287	385.2451	405.4834	645.2935	987.2985	1318.4175	1595.0995	(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	694.8144	569.8849	511.9270	337.3804	194.8514	0.0000	0.0000	0.0000	0.0000	301.4179	503.5115	705.8811	(98)
Space heating												3819.6688	(98)
Space heating per m2												35.7112	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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													4220.6285 (211)
Space heating requirement	694.8144	569.8849	511.9270	337.3804	194.8514	0.0000	0.0000	0.0000	0.0000	301.4179	503.5115	705.8811	(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)	767.7507	629.7071	565.6652	372.7960	215.3054	0.0000	0.0000	0.0000	0.0000	333.0585	556.3663	779.9792	(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	89.9056	89.9504	90.0058	90.1021	90.2107	87.3000	87.3000	87.3000	87.3000	89.7177	89.8246	87.3000	(216)
Fuel for water heating, kWh/month	170.0635	126.7313	100.1997	51.2866	20.7097	3.6844	0.0000	30.4883	56.6512	104.8612	144.6604	168.8694	(219)
Water heating fuel used												978.2058	(219)
Annual totals kWh/year													
Space heating fuel - main system												4220.6285	(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)												479.6179	(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												5110.7111	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4220.6285	3.4800	146.8779	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	978.2058	3.4800	34.0416	(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	479.6179	13.1900	63.2616	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-692.7410	13.1900	-91.3725	(252)
Total energy cost			289.2960	(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] =	0.7996 (257)
SAP value			88.8458
SAP rating (Section 12)			89 (258)
SAP band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4220.6285	0.2160	911.6558 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	978.2058	0.2160	211.2924 (264)
Space and water heating			1122.9482 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	479.6179	0.5190	248.9217 (268)
Energy saving/generation technologies			
PV Unit	-692.7410	0.5190	-359.5326 (269)
Total kg/year			1077.2123 (272)
CO2 emissions per m2			10.0700 (273)
EI value			90.5010
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1529 (8)
Pressure test					Yes
Measured/design AP50					3.9600
Infiltration rate					0.3509 (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) = 0.3246 (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	0.3570	0.3327	0.3327	0.3165	0.3165	0.3002	0.3002	0.2840	0.2840	0.3083	0.3002	0.3165 (22b)
Effective ac	0.5637	0.5553	0.5553	0.5501	0.5501	0.5451	0.5451	0.5403	0.5403	0.5475	0.5451	0.5501 (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)			11.3400	1.3258	15.0341		(27)
Heat Loss Floor			41.1300	0.1600	6.5808	75.0000	3084.7500 (28a)
External Wall	105.4600	12.1300	93.3300	0.2000	18.6660	9.0000	839.9700 (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) =	51.4171		(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) = 9114.3500 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							85.2127 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							17.1941 (36)
Total fabric heat loss							(33) + (36) = 68.6112 (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	48.6722	47.9474	47.9474	47.4926	47.4926	47.0606	47.0606	46.6513	46.6513	47.2737	47.0606	47.4926 (38)
Average = Sum(39)m / 12 =	117.2834	116.5586	116.5586	116.1038	116.1038	115.6718	115.6718	115.2625	115.2625	115.8849	115.6718	116.1038 (39)
												116.0114 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0965	1.0897	1.0897	1.0855	1.0855	1.0814	1.0814	1.0776	1.0776	1.0834	1.0814	1.0855 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.7953 (42)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Average daily hot water use (litres/day)												100.5882 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	110.6470	106.6235	102.6000	98.5765	94.5529	90.5294	90.5294	94.5529	98.5765	102.6000	106.6235	110.6470 (44)
Energy conte	164.0864	143.5110	148.0905	129.1089	123.8830	106.9016	99.0601	113.6729	115.0305	134.0570	146.3337	158.9089 (45)
Energy content (annual)	Total = Sum(45)m =											1582.6444 (45)
Distribution loss (46)m = 0.15 x (45)m	24.6130	21.5266	22.2136	19.3663	18.5825	16.0352	14.8590	17.0509	17.2546	20.1085	21.9500	23.8363 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1504	12.7697	14.1120	13.6183	14.0377	13.5451	13.9718	14.0145	13.5849	14.0783	13.6640	14.1379 (61)
Total heat required for water heating calculated for each month	178.2367	156.2807	162.2025	142.7271	137.9207	120.4467	113.0319	127.6874	128.6155	148.1353	159.9977	173.0468 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2744 (H8)
Utilisation factor												0.5437 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												100.5882 (H14)
Volume ratio Veff/V												0.7456 (H15)
Solar storage volume factor												0.9413 (H16)
Solar input												-907.6949 (H17)
Solar input	-29.7976	-42.3703	-72.8244	-98.2570	-114.8374	-123.8154	-117.8626	-107.4241	-83.9413	-57.7271	-35.2427	-23.5948 (63)
	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	67.8949	60.3036	49.0422	37.1281	27.7537	23.4308	25.3178	32.9091	44.1705	56.0846	65.4590	69.7819 (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	658.1315	652.3496	625.8291	585.1480	543.4873	506.8231	486.0141	496.0133	520.0280	560.9391	606.0097	640.1098 (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	14.6176		0.6300	0.7000		0.7700	29.9312 (75)				
Southwest				4.6400	45.1778		0.6300	0.7000		0.7700	64.0642 (79)				
Solar gains				93.9954	145.0495	223.5398	317.9103	370.0852	418.6672	383.0816	340.2784	267.5656	177.4686	114.0907	74.9965 (83)
Total gains				752.1269	797.3991	849.3689	903.0583	913.5726	925.4902	869.0957	836.2917	787.5936	738.4077	720.1004	715.1064 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	21.5867	21.7210	21.7210	21.8060	21.8060	21.8875	21.8875	21.9652	21.9652	21.8472	21.8875	21.8060
alpha	2.4391	2.4481	2.4481	2.4537	2.4537	2.4592	2.4592	2.4643	2.4643	2.4565	2.4592	2.4537
util living area	0.9293	0.9158	0.8830	0.8207	0.7119	0.5407	0.4046	0.4168	0.6445	0.8206	0.9021	0.9347 (86)
MIT	18.8840	19.0677	19.4765	19.9926	20.4984	20.8315	20.9434	20.9400	20.7183	20.1779	19.4792	18.8739 (87)
Th 2	20.0037	20.0092	20.0092	20.0127	20.0127	20.0160	20.0160	20.0192	20.0192	20.0144	20.0160	20.0127 (88)
util rest of house	0.9199	0.9046	0.8666	0.7936	0.6632	0.4603	0.2962	0.3063	0.5719	0.7869	0.8868	0.9259 (89)
MIT 2	18.0932	18.2768	18.6763	19.1748	19.6429	19.9217	19.9964	19.9981	19.8428	19.3603	18.6888	18.0902 (90)
Living area fraction	fLA = Living area / (4) = 0.1393 (91)											
MIT	18.2033	18.3870	18.7878	19.2887	19.7621	20.0484	20.1283	20.1293	19.9648	19.4742	18.7989	18.1994 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Temperature adjustment													-0.1500
adjusted MIT	18.0533	18.2370	18.6378	19.1387	19.6121	19.8984	19.9783	19.9793	19.8148	19.3242	18.6489		18.0494 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8960	0.8790	0.8384	0.7652	0.6407	0.4498	0.2918	0.3015	0.5548	0.7583	0.8598	0.9029	(94)
Useful gains	673.8718	700.8950	712.1456	691.0267	585.3117	416.2868	253.6134	252.1420	436.9456	559.9525	619.1403	645.6552	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	1484.0239	1437.9837	1286.5487	1061.0402	756.0801	462.5027	263.5348	262.7206	520.3833	848.7647	1185.5075	1457.0296	(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													
	602.7531	495.3236	427.3559	266.4097	127.0517	0.0000	0.0000	0.0000	0.0000	214.8763	407.7844	603.6625	(98)
Space heating													3145.2172 (98)
Space heating per m2													29.4055 (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													3475.3781 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.7531	495.3236	427.3559	266.4097	127.0517	0.0000	0.0000	0.0000	0.0000	214.8763	407.7844	603.6625	(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)	666.0256	547.3189	472.2165	294.3754	140.3886	0.0000	0.0000	0.0000	0.0000	237.4323	450.5905	667.0304	(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	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)
Efficiency of water heater	89.8492	89.8840	89.9298	90.0279	89.9928	87.3000	87.3000	87.3000	87.3000	89.5282	89.7295	87.3000	(216)
(217)m												89.8465	(217)
Fuel for water heating, kWh/month	165.2092	126.7304	99.3864	49.3959	25.6502	0.0000	0.0000	23.2112	51.1731	100.9829	139.0345	166.3416	(219)
Water heating fuel used												947.1154	(219)
Annual totals kWh/year													
Space heating fuel - main system												3475.3781	(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)												479.6179	(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												4232.6965	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3475.3781	9.7400	338.5018	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	947.1154	9.7400	92.2490	(247)
Pumps and fans for heating	75.0000	36.8500	27.6375	(249)
Pump for solar water heating	50.0000	36.8500	18.4250	(249)
Energy for lighting	479.6179	36.8500	176.7392	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-794.4149	36.8500	-292.7419	(252)
Total energy cost			464.8107	(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	3475.3781	0.2160	750.6817	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	947.1154	0.2160	204.5769	(264)
Space and water heating			955.2586	(265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	479.6179	0.5190	248.9217 (268)
Energy saving/generation technologies			
PV Unit	-794.4149	0.5190	-412.3013 (269)
Total kg/year			856.7539 (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	3475.3781	1.2200	4239.9613 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	947.1154	1.2200	1155.4807 (264)
Space and water heating			5395.4420 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	479.6179	3.0700	1472.4268 (268)
Energy saving/generation technologies			
PV Unit	-794.4149	3.0700	-2438.8536 (269)
Primary energy kWh/year			4812.7652 (272)
Primary energy kWh/m2/year			44.9959 (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	85.2 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	690.71 (P1)
Transmission heat loss coefficient	68.61 (37)
Summer heat loss coefficient	759.32 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South 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 West	4.6400	127.3119	0.6300	0.7000	0.9000	211.0136
total:						464.8243

	Jun	Jul	Aug	
Solar gains	502	465	404	(P3)
Internal gains	504	483	493	
Total summer gains	1006	948	897	(P5)
Summer gain/loss ratio	1.32	1.25	1.18	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 85.2)	1.40	1.40	1.40	
Threshold temperature	18.13	19.95	19.89	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			