



SAP Report Submission for Building Regulations Compliance

Client: Metis Build Ltd

Project: Plot 1, Long Copse Lane
Emsworth, Hampshire, PO10 7UR

Contact: Scott Spearing | BEAT Solutions
01489 565920
scott@beatsolutions.co.uk

Report Issue Date: 10/05/2022

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	SAP-1231 - Plot 1		Issued on Date	10/05/2022	
Assessment Reference	Rev A	Prop Type Ref			
Property	Plot 1, Long Copse Lane, Emsworth, Hampshire, PO10 7UR				
SAP Rating	89 B	DER	11.91	TER	15.06
Environmental	89 B	% DER<TER	20.91		
CO ₂ Emissions (t/year)	1.42	DFEE	47.97	TFEE	55.21
General Requirements Compliance	Pass	% DFEE<TFEE	13.11		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client	Metis Build Ltd, METIS BUILD				

SUMMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	15.06	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	11.91	kgCO ₂ /m ²	Pass
	-3.15 (-20.9%)	kgCO ₂ /m ²	

1b TFE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.21	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	47.97	kWh/m ² /yr	
	-7.2 (-13.0%)	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)	0.19 (max. 0.70)	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.43 (max. 2.00)	1.60 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.00 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoTEC plus 618 VU 186/5-5 (H-GB) R6 Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%	Pass
---------------------	---	------

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 2.25 kWh/day
Permitted by DBSCG 2.56

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.2000 0.1800

Maximum

0.7

Pass

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

10.31 m², No overhang

Windows facing East

6.53 m², No overhang

Windows facing South

13.26 m², No overhang

Windows facing West

1.86 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.10

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Photovoltaic array

1.36

kW

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Property Reference	SAP-1231 - Plot 1			Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref			
Property	Plot 1, Long Copse Lane, Emsworth, Hampshire, PO10 7UR				
SAP Rating	89 B	DER	11.91	TER	15.06
Environmental	89 B	% DER<TER	20.91		
CO ₂ Emissions (t/year)	1.42	DFEE	47.97	TFEE	55.21
General Requirements Compliance	Pass	% DFEE<TFEE	13.11		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client	Metis Build Ltd, METIS BUILD				

SUMMARY FOR INPUT DATA FOR: New Build (As Designed)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements		Heat Loss Perimeter	Internal Floor Area	Average Storey Height
	Ground Floor:	40.41 m	87.77 m ²	2.48 m
	1st Storey:	38.53 m	85.59 m ²	2.65 m

7.0 Living Area	20.71	m ²
-----------------	-------	----------------

8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	187.46	kJ/m ² K

9.0 External Walls						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.19	60.00	202.32	168.26

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - Masonry	Dense block, plasterboard on dabs		75.00	101.17
Internal Wall - Timber	Plasterboard on timber frame		9.00	143.16

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Cold Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	85.59	85.59
Bay Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	2.18	2.18

10.2 Internal Ceilings				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor		9.00	85.59

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.12	110.00	87.77

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	85.59

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Front Door	Manufacturer	Solid Door							1.60
Side Door	Manufacturer	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.50
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
French Doors	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.50

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] External Walls	North							2.10	
Front Elevation	Window	[1] External Walls	North	None	0.00					10.31	
Side Elevation	Window	[1] External Walls	East	None	0.00					4.58	
Side Door	Window	[1] External Walls	East	None	0.00					1.95	
Rear French Doors	Window	[1] External Walls	South	None	0.00					5.70	
Rear Elevation	Window	[1] External Walls	South	None	0.00					7.56	
Side Elevation	Window	[1] External Walls	West	None	0.00					1.86	

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

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	23.80	0.050	Yes	Hi-Therms
Table K1 - Approved	E3 Sill	22.80	0.040	Yes	
Table K1 - Approved	E4 Jamb	47.50	0.050	No	
Table K1 - Approved	E5 Ground floor (normal)	40.41	0.160	Yes	
Table K1 - Approved	E6 Intermediate floor within a dwelling	38.53	0.070	Yes	
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	42.71	0.060	No	
Table K1 - Approved	E16 Corner (normal)	30.60	0.090	No	
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	10.08	-0.090	No	

Y-value	0.048	W/m²K
---------	-------	-------

18.0 Pressure Testing

Designed AP ₅₀	Yes	
Property Tested ?	5.00	m³/(h.m²) @ 50 Pa
As Built AP ₅₀		
		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Windows fully open

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	8.00

Mechanical Ventilation

Mechanical Ventilation System Present	Yes
Approved Installation	Yes
Mechanical Ventilation data Type	Database
Type	Mechanical extract ventilation - decentralised
MV Reference Number	500230
Duct Type	Flexible

19.1 Mechanical extract ventilation - Decentralised

SFP	Fan/Room Type	Count
0.20	In Room Fan Kitchen	1
0.18	In Room Fan Other Wet Room	5

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				0
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

Total number of light fittings	50	
Total number of L.E.L. fittings	50	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	No
------------------------	----

23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Boiler	
Percentage of Heat	100	%
Database Ref. No.	18212	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.6	
In Summer	79.9	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)

25.0 Main Heating 2	None
---------------------	------

Community Heating	None
-------------------	------

28.0 Water Heating

Water Heating	HWP From main heating 1
Flue Gas Heat Recovery System	Main Heating 1
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

Hot Water Cylinder	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Measured Loss
Cylinder Volume	250.00
Loss	2.25
Pipes insulation	Fully insulated primary pipework

L
kWh/day

31.0 Thermal Store

None

32.0 Photovoltaic Unit

One Dwelling

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.36	South	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	£42	B 90	

U-VALUE CALCULATOR REPORT

Property Reference	SAP-1231 - Plot 1	Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref	
Project	Plot 1, Long Copse Lane, Emsworth, Hampshire, PO10 7UR		
Calculation Type	New Build (As Designed)		

SAP Rating	89 B	DER	11.91	TER	15.06
Environmental	89 B	% DER<TER	20.91		
CO ₂ Emissions (t/year)	1.42	DFEE	47.97	TFEE	55.21
General Requirements Compliance	Pass	% DFEE<TFEE	13.11		

Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
Client	Metis Build Ltd, METIS BUILD		

Building Elements

Roof Pitched Cold Roof

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	200	0.0400	5.0000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Mineral wool				
	Main construction	200	0.0400	5.0000	91.67
	Main construction	200	0.1300	1.5385	8.33
	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 = 9.788 m² K/W Lower limit = 9.418 m² K/W Average = 9.603 m² K/W
Total correction = 0.0019 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

U-VALUE CALCULATOR REPORT

Property Reference	SAP-1231 - Plot 1	Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref	
Project	Plot 1, Long Copse Lane, Emsworth, Hampshire, PO10 7UR		
Calculation Type	New Build (As Designed)		

SAP Rating	89 B	DER	11.91	TER	15.06
Environmental	89 B	% DER<TER	20.91		
CO ₂ Emissions (t/year)	1.42	DFEE	47.97	TFEE	55.21
General Requirements Compliance	Pass	% DFEE<TFEE	13.11		

Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
Client	Metis Build Ltd, METIS BUILD		

Building Elements

Roof Bay Roof

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	92.50
	Main construction	100	0.1300	0.7692	7.50
	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 = 10.053 m ² K/W	Lower limit = 9.846 m ² K/W	Average = 9.950 m ² K/W
	Total correction = 0.0005 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 416 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP-1231 - Plot 1	Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref	
Project	Plot 1, Long Copse Lane, Emsworth, Hampshire, PO10 7UR		
Calculation Type	New Build (As Designed)		

SAP Rating	89 B	DER	11.91	TER	15.06
Environmental	89 B	% DER<TER	20.91		
CO ₂ Emissions (t/year)	1.42	DFEE	47.97	TFEE	55.21
General Requirements Compliance	Pass	% DFEE<TFEE	13.11		

Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
Client	Metis Build Ltd, METIS BUILD		

Building Elements

Wall External Walls

Wall Type: Standard Wall

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Brick, outer leaf				
	Main construction	102.5	0.7700	0.1331	82.81
	Main construction	102.5	0.9407	0.1090	17.19
Layer 2	Earthwool Dritherm 37 Standard				
	Main construction	150	0.0370	4.0541	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 3	Supabloc				
	Main construction	100	0.1100	0.9091	94.04
	Main construction	100	0.8803	0.1136	5.96
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 4	airspace/plaster dabs				
	Main construction	15	0.0882	0.1700	80.00
	Main construction	15	0.0882	0.1700	20.00
	Corrections - Cavity Unventilated, Emissivity: Normal				
Layer 5	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 6	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1300	

Total resistance:	Upper limit = 5.444 m ² K/W	Lower limit = 5.231 m ² K/W	Average = 5.337 m ² K/W
	Total correction = 0.0001 m ² K/W	U-value (unrounded) = 0.19 W/m ² K	

Unheated space: None

Total thickness: 383 mm

U-value: 0.19 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

Property Reference	SAP-1231 - Plot 1	Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref	
Project	Plot 1, Long Copse Lane, Emsworth, Hampshire, PO10 7UR		
Calculation Type	New Build (As Designed)		

SAP Rating	89 B	DER	11.91	TER	15.06
Environmental	89 B	% DER<TER	20.91		
CO ₂ Emissions (t/year)	1.42	DFEE	47.97	TFEE	55.21
General Requirements Compliance	Pass	% DFEE<TFEE	13.11		

Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk	Assessor ID	p775-0001
Client	Metis Build Ltd, METIS BUILD		

Building Elements

Floor Ground Floor

Floor Type: Suspended Floor

Area = 87.77 m², Perimeter = 40.41 m, Wall thickness = 320.00 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	Concrete, reinforced (1% steel)				
	Main construction	300	2.3000	0.1304	100.00
Layer 2	Celotex XR4000				
	Main construction	150	0.0220	6.8182	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

Total resistance: Upper limit = 7.354 m² K/W Lower limit = 7.354 m² K/W Average = 7.354 m² K/W

Total correction = 0.0086 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 525 mm

U-value: 0.12 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Property Reference	SAP-1231 - Plot 1			Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref			
Property	Plot 1, Long Copse Lane, Emsworth, Hampshire, PO10 7UR				
SAP Rating	89 B	DER	11.91	TER	15.06
Environmental	89 B	% DER<TER	20.91		
CO ₂ Emissions (t/year)	1.42	DFEE	47.97	TFEE	55.21
General Requirements Compliance	Pass	% DFEE<TFEE	13.11		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client	Metis Build Ltd, METIS BUILD				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 173 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) 15.06 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 11.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.43 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	5.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Vaillant ecoTEC plus 618 VU 186/5-5 (H-GB) R6

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.25 kWh/day

Permitted by DBSCG 2.56	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power:	0.2000 0.1800	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	10.31 m ² , No overhang
Windows facing East:	6.53 m ² , No overhang
Windows facing South:	13.26 m ² , No overhang
Windows facing West:	1.86 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

Roof U-value	0.10 W/m ² K
Roof U-value	0.10 W/m ² K
Floor U-value	0.12 W/m ² K
Photovoltaic array	1.36 kW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												5.0000
Infiltration rate												0.2500 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2500 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.3188	0.3125	0.3063	0.2750	0.2688	0.2375	0.2375	0.2313	0.2500	0.2688	0.2813	0.2938 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5688	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5313	0.5438 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			26.2600	1.3258	34.8144		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			87.7700	0.1200	10.5324	110.0000	9654.7000 (28a)					
External Walls	202.3200	34.0600	168.2600	0.1900	31.9694	60.0000	10095.6000 (29a)					
Pitched Cold Roof	85.5900		85.5900	0.1000	8.5590	9.0000	770.3100 (30)					
Bay Roof	2.1800		2.1800	0.1000	0.2180	9.0000	19.6200 (30)					
Total net area of external elements Aum(A, m2)			377.8600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	97.5192		(33)					
Internal Wall - Masonry			101.1700			75.0000	7587.7500 (32c)					
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)					
Internal Floor			85.5900			18.0000	1540.6200 (32d)					
Internal Ceiling			85.5900			18.0000	1540.6200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	32497.6600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.4577 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0491 (36)					
Total fabric heat loss						(33) + (36) =	115.5683 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 83.4239	Feb 82.5072	Mar 81.5904	Apr 77.0067	May 76.0900	Jun 73.3397	Jul 73.3397	Aug 73.3397	Sep 73.3397	Oct 76.0900	Nov 77.9234	Dec 79.7569 (38)
Heat transfer coeff	198.9923	198.0755	197.1588	192.5750	191.6583	188.9080	188.9080	188.9080	188.9080	191.6583	193.4918	195.3253 (39)
Average = Sum(39)m / 12 =												192.8806 (39)
HLP	Jan 1.1479	Feb 1.1426	Mar 1.1373	Apr 1.1108	May 1.1056	Jun 1.0897	Jul 1.0897	Aug 1.0897	Sep 1.0897	Oct 1.1056	Nov 1.1161	Dec 1.1267 (40)
HLP (average)												1.1126 (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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	115.1342	110.9475	106.7608	102.5741	98.3874	94.2007	94.2007	98.3874	102.5741	106.7608	110.9475	115.1342 (44)
Energy conte	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	25.6111	22.3996	23.1144	20.1517	19.3360	16.6855	15.4616	17.7424	17.9543	20.9240	22.8402	24.8030 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												
Primary loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Solar input	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (62)
Solar input (sum of months) = Sum(63)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 (63)
Output from w/h	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (64)
Heat gains from water heating, kWh/month	105.5132	93.6775	99.9789	91.8392	91.6035	84.1559	83.0151	88.0709	86.9683	95.1235	97.7987	103.7219 (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	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2945	27.7955	22.6048	17.1133	12.7924	10.7999	11.6696	15.1686	20.3593	25.8508	30.1717	32.1643 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9610	348.5406	339.5201	320.3165	296.0754	273.2922	258.0716	254.4920	263.5125	282.7161	306.9572	329.7404 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353 (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)	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821 (71)
Water heating gains (Table 5)	141.8188	139.4010	134.3802	127.5545	123.1230	116.8832	111.5795	118.3749	120.7894	127.8542	135.8316	139.4111 (72)
Total internal gains	588.5801	586.2429	567.0109	535.4901	502.4965	471.4810	451.8265	458.5413	475.1669	506.9269	543.4663	571.8216 (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
North						10.3100	10.6334		0.6300	0.7000	0.7700		33.5044 (74)
East						6.5300	19.6403		0.6300	0.7000	0.7700		39.1951 (76)
South						7.5600	46.7521		0.6300	0.7000	0.7700		108.0176 (78)
West						1.8600	19.6403		0.6300	0.7000	0.7700		11.1643 (80)
South						5.7000	46.7521		0.6300	0.7000	0.7700		81.4418 (78)

Solar gains	273.3233	472.8282	666.2875	858.0931	990.9066	996.8569	955.6166	854.5128	732.3872	527.7849	328.6984	233.0545	(83)
Total gains	861.9034	1059.0711	1233.2984	1393.5832	1493.4031	1468.3379	1407.4431	1313.0541	1207.5541	1034.7118	872.1647	804.8761	(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	45.3642	45.5742	45.7861	46.8759	47.1001	47.7858	47.7858	47.7858	47.7858	47.1001	46.6538	46.2159
alpha	4.0243	4.0383	4.0524	4.1251	4.1400	4.1857	4.1857	4.1857	4.1857	4.1400	4.1103	4.0811
util living area	0.9968	0.9922	0.9809	0.9481	0.8695	0.7219	0.5620	0.6167	0.8367	0.9670	0.9934	0.9976 (86)
MIT	19.3352	19.5536	19.8832	20.3125	20.6699	20.8979	20.9725	20.9595	20.7993	20.3228	19.7593	19.3174 (87)
Th 2	19.9619	19.9662	19.9705	19.9920	19.9963	20.0093	20.0093	20.0093	20.0093	19.9963	19.9877	19.9791 (88)
util rest of house	0.9959	0.9901	0.9756	0.9328	0.8298	0.6412	0.4480	0.5026	0.7742	0.9545	0.9913	0.9969 (89)
MIT 2	17.7273	18.0485	18.5296	19.1576	19.6458	19.9286	19.9957	19.9874	19.8273	19.1837	18.3639	17.7124 (90)
Living area fraction	17.9194	18.2283	18.6913	19.2955	19.7682	20.0444	20.1124	20.1035	19.9435	19.3198	18.5306	17.9041 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9194	18.2283	18.6913	19.2955	19.7682	20.0444	20.1124	20.1035	19.9435	19.3198	18.5306	17.9041 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9932	0.9849	0.9663	0.9192	0.8192	0.6443	0.4605	0.5143	0.7693	0.9428	0.9867	0.9948 (94)
Ext temp.	856.0369	1043.0495	1191.6778	1280.9479	1223.4144	946.0711	648.1489	675.2547	928.9923	975.5293	860.5370	800.6925 (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)
Heat loss rate W	2710.1543	2640.0119	2403.6160	2001.9220	1546.3314	1028.4960	663.5268	699.6221	1103.8762	1671.2198	2211.7310	2676.7576 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	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	1379.4633	1073.1588	901.6820	519.1014	240.2502	0.0000	0.0000	0.0000	0.0000	517.5938	972.8596	1395.7924 (98)
Space heating												6999.9016 (98)
Space heating per m2											(98) / (4) =	40.3778 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												7726.1607 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1379.4633	1073.1588	901.6820	519.1014	240.2502	0.0000	0.0000	0.0000	0.0000	517.5938	972.8596	1395.7924 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1522.5864	1184.5019	995.2340	572.9596	265.1768	0.0000	0.0000	0.0000	0.0000	571.2956	1073.7965	1540.6097 (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	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (64)
Efficiency of water heater (217)m	88.8883	88.6998	88.3225	87.4233	85.5436	79.9000	79.9000	79.9000	79.9000	87.3353	88.4861	79.9000 (216)
Fuel for water heating, kWh/month	260.6283	230.3974	243.4527	221.1159	221.9155	213.0149	205.2625	224.2931	223.6013	229.4843	238.7155	254.4238 (219)
Water heating fuel used												2766.3053 (219)
Annual totals kWh/year												
Space heating fuel - main system												7726.1607 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)												
mechanical ventilation fans (SFP = 0.2681)												145.3896 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												220.3896 (231)
Electricity for lighting (calculated in Appendix L)												552.6704 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.36 * 1068 * 1.00) =									-1162.0607			-1162.0607 (233)
Total delivered energy for all uses												10103.4653 (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	7726.1607	0.2160	1668.8507 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2766.3053	0.2160	597.5220 (264)
Space and water heating			2266.3727 (265)
Pumps and fans	220.3896	0.5190	114.3822 (267)
Energy for lighting	552.6704	0.5190	286.8360 (268)
Energy saving/generation technologies			
PV Unit	-1162.0607	0.5190	-603.1095 (269)
Total CO2, kg/year			2064.4813 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.9100 (273)

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

DER			11.9100 ZC1
Total Floor Area		TFA	173.3600
Assumed number of occupants		N	2.9671
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			11.7915 ZC2
CO2 emissions from cooking, equation (L16)			1.0972 ZC3
Total CO2 emissions			24.7986 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			24.7986 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.0900 (8)
Pressure test										Yes							
Measured/design AP50																	5.0000
Infiltration rate																	0.3400 (18)
Number of sides sheltered																	0 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							1.0000 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3400 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995	(22b)				
Effective ac	0.5940	0.5903	0.5867	0.5699	0.5668	0.5522	0.5522	0.5495	0.5578	0.5668	0.5731	0.5798	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1000	1.0000	2.1000			(26)					
TER Opening Type (Uw = 1.40)			31.9600	1.3258	42.3712			(27)					
Ground Floor			87.7700	0.1300	11.4101			(28a)					
External Walls	202.3200	34.0600	168.2600	0.1800	30.2868			(29a)					
Pitched Cold Roof	85.5900		85.5900	0.1300	11.1267			(30)					
Bay Roof	2.1800		2.1800	0.1300	0.2834			(30)					
Total net area of external elements Aum(A, m2)			377.8600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	97.5782			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								15.5800 (36)					
Total fabric heat loss						(33) + (36) =		113.1582 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 87.1212	Feb 86.5861	Mar 86.0615	Apr 83.5977	May 83.1367	Jun 80.9908	Jul 80.9908	Aug 80.5934	Sep 81.8174	Oct 83.1367	Nov 84.0693	Dec 85.0442	(38)
Heat transfer coeff	200.2795	199.7443	199.2197	196.7559	196.2949	194.1490	194.1490	193.7516	194.9756	196.2949	197.2275	198.2024	(39)
Average = Sum(39)m / 12 =												196.7537	(39)
HLP	Jan 1.1553	Feb 1.1522	Mar 1.1492	Apr 1.1350	May 1.1323	Jun 1.1199	Jul 1.1199	Aug 1.1176	Sep 1.1247	Oct 1.1323	Nov 1.1377	Dec 1.1433	(40)
HLP (average)												1.1349	(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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Daily hot water use	Jan 115.1342	Feb 110.9475	Mar 106.7608	Apr 102.5741	May 98.3874	Jun 94.2007	Jul 94.2007	Aug 98.3874	Sep 102.5741	Oct 106.7608	Nov 110.9475	Dec 115.1342 (44)
Energy conte	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)
Energy content (annual)												Total = Sum(45)m = 1646.8270 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6111	22.3996	23.1144	20.1517	19.3360	16.6855	15.4616	17.7424	17.9543	20.9240	22.8402	24.8030 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0208 (55)
Total storage loss													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(56)
If cylinder contains dedicated solar storage													
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
225.6475	198.9242	209.0029	187.4804	183.8138	164.3725	157.9842	173.1896	172.8311	194.4003	205.4037	220.2601	220.2601	(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) =													(63)
Output from w/h													
225.6475	198.9242	209.0029	187.4804	183.8138	164.3725	157.9842	173.1896	172.8311	194.4003	205.4037	220.2601	220.2601	(64)
Heat gains from water heating, kWh/month													
100.6967	89.3271	95.1624	87.1781	86.7870	79.4948	78.1987	83.2545	82.3072	90.3070	93.1376	98.9054	98.9054	(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	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
31.2945	27.7955	22.6048	17.1133	12.7924	10.7999	11.6696	15.1686	20.3593	25.8508	30.1717	32.1643	32.1643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
344.9610	348.5406	339.5201	320.3165	296.0754	273.2922	258.0716	254.4920	263.5125	282.7161	306.9572	329.7404	329.7404	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	(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)													
-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	(71)
Water heating gains (Table 5)													
135.3451	132.9273	127.9065	121.0807	116.6492	110.4094	105.1057	111.9012	114.3156	121.3804	129.3578	132.9374	132.9374	(72)
Total internal gains													
582.1064	579.7692	560.5372	529.0163	496.0228	465.0072	445.3527	452.0675	468.6932	500.4531	536.9925	565.3478	565.3478	(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		
North					10.3100	10.6334	0.6300	0.7000		0.7700		33.5044 (74)
East					6.5300	19.6403	0.6300	0.7000		0.7700		39.1951 (76)
South					13.2600	46.7521	0.6300	0.7000		0.7700		189.4594 (78)
West					1.8600	19.6403	0.6300	0.7000		0.7700		11.1643 (80)
Solar gains	273.3233	472.8282	666.2875	858.0931	990.9066	996.8569	955.6166	854.5128	732.3872	527.7849	328.6984	233.0545 (83)
Total gains	855.4297	1052.5973	1226.8247	1387.1094	1486.9293	1461.8641	1400.9693	1306.5803	1201.0804	1028.2380	865.6909	798.4023 (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	60.1105	60.2715	60.4302	61.1869	61.3306	62.0085	62.0085	62.1357	61.7456	61.3306	61.0406	60.7404	
alpha	5.0074	5.0181	5.0287	5.0791	5.0887	5.1339	5.1339	5.1424	5.1164	5.0887	5.0694	5.0494	
util living area													
0.9992	0.9975	0.9922	0.9721	0.9085	0.7623	0.5900	0.6486	0.8800	0.9846	0.9980	0.9994	0.9994	(86)
MIT	19.6524	19.8271	20.0944	20.4392	20.7420	20.9301	20.9850	20.9761	20.8431	20.4407	19.9806	19.6267	(87)
Th 2	19.9559	19.9584	19.9609	19.9724	19.9745	19.9846	19.9846	19.9865	19.9807	19.9745	19.9702	19.9656	(88)
util rest of house													
0.9989	0.9966	0.9893	0.9608	0.8703	0.6734	0.4639	0.5219	0.8165	0.9765	0.9972	0.9992	0.9992	(89)
MIT 2	18.1478	18.4049	18.7959	19.2994	19.7118	19.9359	19.9788	19.9762	19.8485	19.3090	18.6381	18.1170	(90)
Living area fraction													
fLA = Living area / (4) =													(91)
MIT	18.3275	18.5748	18.9510	19.4356	19.8348	20.0547	20.0990	20.0956	19.9673	19.4442	18.7984	18.2974	(92)
Temperature adjustment													
adjusted MIT	18.3275	18.5748	18.9510	19.4356	19.8348	20.0547	20.0990	20.0956	19.9673	19.4442	18.7984	18.2974	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9982	0.9948	0.9851	0.9529	0.8641	0.6802	0.4788	0.5365	0.8155	0.9704	0.9956	0.9987	0.9987	(94)
Useful gains	853.8849	1047.1757	1208.5791	1321.7861	1284.7865	994.2909	670.7167	700.9728	979.4470	997.8161	861.9236	797.3806	(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													
2809.4205	2731.4560	2480.4894	2072.9376	1596.8284	1059.0168	679.3327	716.0311	1143.9756	1736.0687	2307.2554	2794.1309	2794.1309	(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													
1454.9185	1131.8363	946.3013	540.8291	232.1591	0.0000	0.0000	0.0000	0.0000	549.2600	1040.6390	1485.5822	1485.5822	(98)
Space heating													
Space heating per m2													
(98) / (4) =													(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7894.6797 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1454.9185	1131.8363	946.3013	540.8291	232.1591	0.0000	0.0000	0.0000	0.0000	549.2600	1040.6390	1485.5822	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1556.0626	1210.5201	1012.0869	578.4269	248.2986	0.0000	0.0000	0.0000	0.0000	587.4438	1112.9829	1588.8580	(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	225.6475	198.9242	209.0029	187.4804	183.8138	164.3725	157.9842	173.1896	172.8311	194.4003	205.4037	220.2601	(64)
Efficiency of water heater (217)m	88.8995	88.7217	88.3567	87.4805	85.4377	79.8000	79.8000	79.8000	79.8000	87.4353	88.5429	79.8000	(216)
Fuel for water heating, kWh/month	253.8232	224.2113	236.5444	214.3110	215.1435	205.9806	197.9751	217.0295	216.5803	222.3362	231.9821	247.5950	(219)
Water heating fuel used												2683.5123	(219)
Annual totals kWh/year													
Space heating fuel - main system												7894.6797	(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)												552.6704	(232)
Total delivered energy for all uses												11205.8625	(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	7894.6797	0.2160	1705.2508 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2683.5123	0.2160	579.6387 (264)
Space and water heating			2284.8895 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	552.6704	0.5190	286.8360 (268)
Total CO2, kg/m2/year			2610.6504 (272)
Emissions per m2 for space and water heating			13.1800 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6546 (272b)
Emissions per m2 for pumps and fans			0.2245 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.1800 * 1.00) + 1.6546 + 0.2245, rounded to 2 d.p.			15.0600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (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) = 0.0900 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3400 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3400 (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	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995 (22b)
Effective ac	0.5940	0.5903	0.5867	0.5699	0.5668	0.5522	0.5522	0.5495	0.5578	0.5668	0.5731	0.5798 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1000	1.6000	3.3600		(26)
Windows (Uw = 1.40)			26.2600	1.3258	34.8144		(27)
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)
Ground Floor			87.7700	0.1200	10.5324	110.0000	9654.7000 (28a)
External Walls	202.3200	34.0600	168.2600	0.1900	31.9694	60.0000	10095.6000 (29a)
Pitched Cold Roof	85.5900		85.5900	0.1000	8.5590	9.0000	770.3100 (30)
Bay Roof	2.1800		2.1800	0.1000	0.2180	9.0000	19.6200 (30)
Total net area of external elements Aum(A, m ²)			377.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	97.5192		(33)
Internal Wall - Masonry			101.1700			75.0000	7587.7500 (32c)
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)
Internal Floor			85.5900			18.0000	1540.6200 (32d)
Internal Ceiling			85.5900			9.0000	770.3100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	31727.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							183.0142 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0491 (36)
Total fabric heat loss						(33) + (36) =	115.5683 (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	87.1212	86.5861	86.0615	83.5977	83.1367	80.9908	80.9908	80.5934	81.8174	83.1367	84.0693	85.0442 (38)
Heat transfer coeff	202.6896	202.1544	201.6299	199.1660	198.7051	196.5591	196.5591	196.1618	197.3857	198.7051	199.6376	200.6125 (39)
Average = Sum(39)m / 12 =												199.1638 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1692	1.1661	1.1631	1.1489	1.1462	1.1338	1.1338	1.1315	1.1386	1.1462	1.1516	1.1572 (40)
HLP (average)												1.1488 (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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.1342	110.9475	106.7608	102.5741	98.3874	94.2007	94.2007	98.3874	102.5741	106.7608	110.9475	115.1342 (44)
	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1646.8270 (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	36.2824	31.7328	32.7454	28.5483	27.3927	23.6378	21.9039	25.1351	25.4353	29.6424	32.3570	35.1376 (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)
(66)m	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2945	27.7955	22.6048	17.1133	12.7924	10.7999	11.6696	15.1686	20.3593	25.8508	30.1717	32.1643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9610	348.5406	339.5201	320.3165	296.0754	273.2922	258.0716	254.4920	263.5125	282.7161	306.9572	329.7404	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	(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)	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	(71)
Water heating gains (Table 5)	48.7667	47.2215	44.0127	39.6504	36.8182	32.8303	29.4408	33.7837	35.3268	39.8419	44.9402	47.2279	(72)
Total internal gains	492.5280	491.0634	473.6434	444.5860	413.1918	384.4282	366.6878	370.9501	386.7044	415.9146	449.5750	476.6384	(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		
North					10.3100	10.6334	0.6300	0.7000	0.7700	33.5044 (74)		
East					6.5300	19.6403	0.6300	0.7000	0.7700	39.1951 (76)		
South					7.5600	46.7521	0.6300	0.7000	0.7700	108.0176 (78)		
West					1.8600	19.6403	0.6300	0.7000	0.7700	11.1643 (80)		
South					5.7000	46.7521	0.6300	0.7000	0.7700	81.4418 (78)		
Solar gains	273.3233	472.8282	666.2875	858.0931	990.9066	996.8569	955.6166	854.5128	732.3872	527.7849	328.6984	233.0545 (83)
Total gains	765.8513	963.8915	1139.9309	1302.6791	1404.0983	1381.2851	1322.3044	1225.4629	1119.0916	943.6995	778.2733	709.6929 (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	43.4810	43.5961	43.7096	44.2503	44.3529	44.8372	44.8372	44.9280	44.6494	44.3529	44.1458	43.9312	
alpha	3.8987	3.9064	3.9140	3.9500	3.9569	3.9891	3.9891	3.9952	3.9766	3.9569	3.9431	3.9287	
util living area	0.9976	0.9939	0.9846	0.9575	0.8911	0.7606	0.6068	0.6634	0.8691	0.9750	0.9952	0.9983	(86)
MIT	19.2065	19.4273	19.7656	20.2007	20.5894	20.8569	20.9569	20.9383	20.7317	20.2114	19.6256	19.1735	(87)
Th 2	19.9447	19.9472	19.9497	19.9611	19.9633	19.9733	19.9733	19.9752	19.9694	19.9633	19.9589	19.9544	(88)
util rest of house	0.9970	0.9923	0.9802	0.9446	0.8555	0.6810	0.4850	0.5442	0.8127	0.9652	0.9937	0.9978	(89)
MIT 2	18.2973	18.5192	18.8570	19.2925	19.6601	19.8936	19.9583	19.9514	19.7978	19.3100	18.7265	18.2716	(90)
Living area fraction	18.4059	18.6277	18.9656	19.4010	19.7711	20.0087	20.0776	20.0693	fLA = Living area / (4) =	19.4177	18.8339	0.1195	(91)
MIT	18.4059	18.6277	18.9656	19.4010	19.7711	20.0087	20.0776	20.0693	19.9093	19.4177	18.8339	18.3793	(92)
Temperature adjustment	18.4059	18.6277	18.9656	19.4010	19.7711	20.0087	20.0776	20.0693	19.9093	19.4177	18.8339	0.0000	
adjusted MIT	18.4059	18.6277	18.9656	19.4010	19.7711	20.0087	20.0776	20.0693	19.9093	19.4177	18.8339	18.3793	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9957	0.9895	0.9747	0.9357	0.8476	0.6841	0.4983	0.5563	0.8087	0.9582	0.9913	0.9968	(94)
Ext temp.	762.5476	953.7261	1111.1277	1218.9250	1190.0863	944.9399	658.8865	681.6712	904.9773	904.2277	771.5020	707.4121	(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	2859.1265	2775.1083	2513.4327	2091.4470	1603.7645	1063.1292	683.5526	719.7818	1146.6805	1752.1136	2342.5232	2844.5519	(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	1559.8547	1223.9688	1043.3149	628.2158	307.7766	0.0000	0.0000	0.0000	0.0000	630.8271	1131.1353	1590.0320	(98)
Space heating per m2	(98) / (4) = 46.8108 (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	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1847.6560	1454.5377	1490.8294	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7768	0.8519	0.8188	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1435.2764	1239.0757	1220.7580	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1747.9966	1675.8612	1565.4357	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	225.1586	324.9684	256.4402	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												806.5671	(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	56.2896	81.2421	64.1100	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												201.6418	(107)
Space cooling per m2												1.1631	(108)
Energy for space heating												46.8108	(99)
Energy for space cooling												1.1631	(108)
Total												47.9740	(109)
Dwelling Fabric Energy Efficiency (DFEE)												48.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (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) = 0.0900 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3400 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3400 (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	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995 (22b)
Effective ac	0.5940	0.5903	0.5867	0.5699	0.5668	0.5522	0.5522	0.5495	0.5578	0.5668	0.5731	0.5798 (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			2.1000	1.0000	2.1000		(26)
TER Opening Type (Uw = 1.40)			31.9600	1.3258	42.3712		(27)
Ground Floor			87.7700	0.1300	11.4101		(28a)
External Walls	202.3200	34.0600	168.2600	0.1800	30.2868		(29a)
Pitched Cold Roof	85.5900		85.5900	0.1300	11.1267		(30)
Bay Roof	2.1800		2.1800	0.1300	0.2834		(30)
Total net area of external elements Aum(A, m ²)			377.8600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	97.5782	(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)							15.5800 (36)
Total fabric heat loss						(33) + (36) =	113.1582 (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	87.1212	86.5861	86.0615	83.5977	83.1367	80.9908	80.9908	80.5934	81.8174	83.1367	84.0693	85.0442 (38)
Heat transfer coeff	200.2795	199.7443	199.2197	196.7559	196.2949	194.1490	194.1490	193.7516	194.9756	196.2949	197.2275	198.2024 (39)
Average = Sum(39)m / 12 =												196.7537 (39)
HLP	1.1553	1.1522	1.1492	1.1350	1.1323	1.1199	1.1199	1.1176	1.1247	1.1323	1.1377	1.1433 (40)
HLP (average)												1.1349 (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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.1342	110.9475	106.7608	102.5741	98.3874	94.2007	94.2007	98.3874	102.5741	106.7608	110.9475	115.1342 (44)
Energy content (annual)	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1646.8270 (45)
Water 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 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	36.2824	31.7328	32.7454	28.5483	27.3927	23.6378	21.9039	25.1351	25.4353	29.6424	32.3570	35.1376 (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	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	148.3526	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2945	27.7955	22.6048	17.1133	12.7924	10.7999	11.6696	15.1686	20.3593	25.8508	30.1717	32.1643	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.9610	348.5406	339.5201	320.3165	296.0754	273.2922	258.0716	254.4920	263.5125	282.7161	306.9572	329.7404	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	37.8353	(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)	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	(71)
Water heating gains (Table 5)	48.7667	47.2215	44.0127	39.6504	36.8182	32.8303	29.4408	33.7837	35.3268	39.8419	44.9402	47.2279	(72)
Total internal gains	492.5280	491.0634	473.6434	444.5860	413.1918	384.4282	366.6878	370.9501	386.7044	415.9146	449.5750	476.6384	(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	
North	10.3100	10.6334	0.6300	0.7000	0.7700	33.5044	(74)
East	6.5300	19.6403	0.6300	0.7000	0.7700	39.1951	(76)
South	13.2600	46.7521	0.6300	0.7000	0.7700	189.4594	(78)
West	1.8600	19.6403	0.6300	0.7000	0.7700	11.1643	(80)

Solar gains	273.3233	472.8282	666.2875	858.0931	990.9066	996.8569	955.6166	854.5128	732.3872	527.7849	328.6984	233.0545	(83)
Total gains	765.8513	963.8915	1139.9309	1302.6791	1404.0983	1381.2851	1322.3044	1225.4629	1119.0916	943.6995	778.2733	709.6929	(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	60.1105	60.2715	60.4302	61.1869	61.3306	62.0085	62.0085	62.1357	61.7456	61.3306	61.0406	60.7404	
alpha	5.0074	5.0181	5.0287	5.0791	5.0887	5.1339	5.1339	5.1424	5.1164	5.0887	5.0694	5.0494	
util living area	0.9995	0.9983	0.9943	0.9783	0.9239	0.7897	0.6200	0.6824	0.9030	0.9893	0.9988	0.9997	(86)
MIT	19.6041	19.7796	20.0490	20.3990	20.7129	20.9173	20.9812	20.9700	20.8178	20.3979	19.9336	19.5787	(87)
Th 2	19.9559	19.9584	19.9609	19.9724	19.9745	19.9846	19.9846	19.9865	19.9807	19.9745	19.9702	19.9656	(88)
util rest of house	0.9993	0.9977	0.9922	0.9691	0.8902	0.7031	0.4900	0.5533	0.8465	0.9834	0.9983	0.9996	(89)
MIT 2	18.6731	18.8504	19.1207	19.4747	19.7711	19.9441	19.9796	19.9773	19.8723	19.4788	19.0138	18.6555	(90)
Living area fraction									fLA = Living area / (4) =			0.1195	(91)
MIT	18.7844	18.9614	19.2316	19.5852	19.8836	20.0604	20.0992	20.0959	19.9852	19.5886	19.1237	18.7658	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7844	18.9614	19.2316	19.5852	19.8836	20.0604	20.0992	20.0959	19.9852	19.5886	19.1237	18.7658	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9991	0.9969	0.9901	0.9646	0.8865	0.7104	0.5055	0.5684	0.8468	0.9803	0.9976	0.9994	(94)
Ext temp.	765.1352	960.9309	1128.5923	1256.5920	1244.7366	981.2071	668.3690	696.5836	947.6429	925.1127	776.4285	709.2444	(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	2900.9183	2808.6888	2536.3842	2102.3680	1606.3953	1060.1327	679.3707	716.0880	1147.4723	1764.4191	2371.3995	2886.9768	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1589.0226	1241.6933	1047.3972	608.9587	269.0741	0.0000	0.0000	0.0000	0.0000	624.4439	1148.3791	1620.2329	(98)
										(98) / (4) =		47.0074	(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	1825.0009	1436.7028	1472.5125	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8184	0.8941	0.8617	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1493.5989	1284.5147	1268.8533	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1747.9966	1675.8612	1565.4357	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	183.1664	291.1618	220.6573	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												694.9855 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	45.7916	72.7905	55.1643	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												173.7464 (107)
Energy for space heating												1.0022 (108)
Energy for space cooling												47.0074 (99)
Total												1.0022 (108)
Target Fabric Energy Efficiency (TFEE)												48.0096 (109)
												55.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												5.0000
Infiltration rate												0.2500 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2500 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000 (22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250 (22a)
Adj infilt rate												
	0.2875	0.2625	0.2563	0.2500	0.2625	0.2313	0.2438	0.2313	0.2313	0.2500	0.2438	0.2563 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5375	0.5125	0.5063	0.5000	0.5125	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5063 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			26.2600	1.3258	34.8144		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			87.7700	0.1200	10.5324	110.0000	9654.7000 (28a)					
External Walls	202.3200	34.0600	168.2600	0.1900	31.9694	60.0000	10095.6000 (29a)					
Pitched Cold Roof	85.5900		85.5900	0.1000	8.5590	9.0000	770.3100 (30)					
Bay Roof	2.1800		2.1800	0.1000	0.2180	9.0000	19.6200 (30)					
Total net area of external elements Aum(A, m2)			377.8600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.5192		(33)					
Internal Wall - Masonry			101.1700			75.0000	7587.7500 (32c)					
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)					
Internal Floor			85.5900			18.0000	1540.6200 (32d)					
Internal Ceiling			85.5900			18.0000	1540.6200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		32497.6600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.4577 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0491 (36)					
Total fabric heat loss						(33) + (36) =	115.5683 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 78.8402	Feb 75.1732	Mar 74.2565	Apr 73.3397	May 75.1732	Jun 73.3397	Jul 73.3397	Aug 73.3397	Sep 73.3397	Oct 73.3397	Nov 73.3397	Dec 74.2565 (38)
Heat transfer coeff	194.4085	190.7415	189.8248	188.9080	190.7415	188.9080	188.9080	188.9080	188.9080	188.9080	188.9080	189.8248 (39)
Average = Sum(39)m / 12 =												189.8248 (39)
HLP	Jan 1.1214	Feb 1.1003	Mar 1.0950	Apr 1.0897	May 1.1003	Jun 1.0897	Jul 1.0897	Aug 1.0897	Sep 1.0897	Oct 1.0897	Nov 1.0897	Dec 1.0950 (40)
HLP (average)												1.0950 (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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	115.1342	110.9475	106.7608	102.5741	98.3874	94.2007	94.2007	98.3874	102.5741	106.7608	110.9475	115.1342 (44)
Energy conte	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	25.6111	22.3996	23.1144	20.1517	19.3360	16.6855	15.4616	17.7424	17.9543	20.9240	22.8402	24.8030 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (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	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (64)
Total per year (kWh/year) = Sum(64)m =												2364.1980 (64)
RHI water heating demand												2364 (64)
Heat gains from water heating, kWh/month	105.5132	93.6775	99.9789	91.8392	91.6035	84.1559	83.0151	88.0709	86.9683	95.1235	97.7987	103.7219 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.2362	69.4887	56.5120	42.7832	31.9810	26.9997	29.1741	37.9216	50.8983	64.6271	75.4294	80.4106 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	514.8672	520.2099	506.7465	478.0844	441.9036	407.8988	385.1815	379.8388	393.3022	421.9643	458.1451	492.1499 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694 (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)	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821 (71)
Water heating gains (Table 5)	141.8188	139.4010	134.3802	127.5545	123.1230	116.8832	111.5795	118.3749	120.7894	127.8542	135.8316	139.4111 (72)
Total internal gains	853.0327	847.2101	815.7491	766.5325	715.1179	669.8920	644.0455	654.2457	683.1003	732.5560	787.5164	830.0821 (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
North				10.3100	14.6401		0.6300		0.7000		0.7700		46.1290 (74)
East				6.5300	27.3735		0.6300		0.7000		0.7700		54.6279 (76)
South				7.5600	61.3950		0.6300		0.7000		0.7700		141.8490 (78)
West				1.8600	27.3735		0.6300		0.7000		0.7700		15.5602 (80)
South				5.7000	61.3950		0.6300		0.7000		0.7700		106.9497 (78)
Solar gains	365.1158	519.4118	732.3950	971.8857	1089.5464	1175.3463	1125.1775	1003.7575	858.6101	619.2020	420.9902	302.0074	(83)
Total gains	1218.1485	1366.6218	1548.1441	1738.4181	1804.6644	1845.2383	1769.2229	1658.0032	1541.7104	1351.7580	1208.5066	1132.0895	(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	46.4338	47.3265	47.5551	47.7858	47.3265	47.7858	47.7858	47.7858	47.7858	47.7858	47.5551	47.5551
alpha	4.0956	4.1551	4.1703	4.1857	4.1551	4.1857	4.1857	4.1857	4.1857	4.1857	4.1857	4.1703
util living area	0.9859	0.9768	0.9489	0.8746	0.7332	0.5139	0.3494	0.3612	0.6429	0.8872	0.9703	0.9885 (86)
MIT	19.7417	19.9185	20.2392	20.6053	20.8615	20.9766	20.9965	20.9961	20.9414	20.6570	20.1732	19.7532 (87)
Th 2	19.9834	20.0006	20.0049	20.0093	20.0006	20.0093	20.0093	20.0093	20.0093	20.0093	20.0093	20.0049 (88)
util rest of house	0.9822	0.9709	0.9358	0.8431	0.6701	0.4236	0.2460	0.2511	0.5511	0.8497	0.9612	0.9854 (89)
MIT 2	18.3327	18.5993	19.0595	19.5640	19.8746	19.9957	20.0083	20.0083	19.9692	19.6439	18.9749	18.3645 (90)
Living area fraction									fLA = Living area / (4) =			0.1195 (91)
MIT	18.5011	18.7569	19.2004	19.6883	19.9925	20.1129	20.1264	20.1263	20.0853	19.7649	19.1180	18.5304 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5011	18.7569	19.2004	19.6883	19.9925	20.1129	20.1264	20.1263	20.0853	19.7649	19.1180	18.5304 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1187.2049	1313.2570	1427.8904	1445.0175	1208.2789	799.6656	457.1695	438.2099	861.2763	1133.6388	1148.1713	1108.0849 (95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	2566.3999	2490.4908	2240.0101	1849.0980	1333.7529	814.7404	458.3611	439.4568	903.9855	1466.8552	2024.7224	2473.4938	(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	1026.1211	791.1011	604.2170	290.9380	93.3527	0.0000	0.0000	0.0000	0.0000	247.9130	631.1168	1015.8643	(98)
RHI space heating demand												4700.6241	(98)
												4701	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (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					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2500 (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	0.3188	0.3125	0.3063	0.2750	0.2688	0.2375	0.2375	0.2313	0.2500	0.2688	0.2813	0.2938 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5688	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5313	0.5438 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1000	1.6000	3.3600		(26)
Windows (Uw = 1.40)			26.2600	1.3258	34.8144		(27)
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)
Ground Floor			87.7700	0.1200	10.5324	110.0000	9654.7000 (28a)
External Walls	202.3200	34.0600	168.2600	0.1900	31.9694	60.0000	10095.6000 (29a)
Pitched Cold Roof	85.5900		85.5900	0.1000	8.5590	9.0000	770.3100 (30)
Bay Roof	2.1800		2.1800	0.1000	0.2180	9.0000	19.6200 (30)
Total net area of external elements Aum(A, m ²)			377.8600				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.5192		(33)
Internal Wall - Masonry			101.1700			75.0000	7587.7500 (32c)
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)
Internal Floor			85.5900			18.0000	1540.6200 (32d)
Internal Ceiling			85.5900			18.0000	1540.6200 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 32497.6600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 187.4577 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 18.0491 (36)
Total fabric heat loss (33) + (36) = 115.5683 (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	83.4239	82.5072	81.5904	77.0067	76.0900	73.3397	73.3397	73.3397	73.3397	76.0900	77.9234	79.7569 (38)
Heat transfer coeff	198.9923	198.0755	197.1588	192.5750	191.6583	188.9080	188.9080	188.9080	188.9080	191.6583	193.4918	195.3253 (39)
Average = Sum(39)m / 12 =												192.8806 (39)
HLP	1.1479	1.1426	1.1373	1.1108	1.1056	1.0897	1.0897	1.0897	1.0897	1.1056	1.1161	1.1267 (40)
HLP (average)												1.1126 (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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	115.1342	110.9475	106.7608	102.5741	98.3874	94.2007	94.2007	98.3874	102.5741	106.7608	110.9475	115.1342 (44)
Energy conte	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	25.6111	22.3996	23.1144	20.1517	19.3360	16.6855	15.4616	17.7424	17.9543	20.9240	22.8402	24.8030 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												
Primary loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Solar input	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (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)
Heat gains from water heating, kWh/month												
Total per year (kWh/year) = Sum(64)m =	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (64)
	105.5132	93.6775	99.9789	91.8392	91.6035	84.1559	83.0151	88.0709	86.9683	95.1235	97.7987	103.7219 (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	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.2362	69.4887	56.5120	42.7832	31.9810	26.9997	29.1741	37.9216	50.8983	64.6271	75.4294	80.4106 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	514.8672	520.2099	506.7465	478.0844	441.9036	407.8988	385.1815	379.8388	393.3022	421.9643	458.1451	492.1499 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694 (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)	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821 (71)
Water heating gains (Table 5)	141.8188	139.4010	134.3802	127.5545	123.1230	116.8832	111.5795	118.3749	120.7894	127.8542	135.8316	139.4111 (72)
Total internal gains	853.0327	847.2101	815.7491	766.5325	715.1179	669.8920	644.0455	654.2457	683.1003	732.5560	787.5164	830.0821 (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		
North				10.3100	10.6334	0.6300	0.7000		0.7700	33.5044 (74)		
East				6.5300	19.6403	0.6300	0.7000		0.7700	39.1951 (76)		
South				7.5600	46.7521	0.6300	0.7000		0.7700	108.0176 (78)		
West				1.8600	19.6403	0.6300	0.7000		0.7700	11.1643 (80)		
South				5.7000	46.7521	0.6300	0.7000		0.7700	81.4418 (78)		
Solar gains	273.3233	472.8282	666.2875	858.0931	990.9066	996.8569	955.6166	854.5128	732.3872	527.7849	328.6984	233.0545 (83)
Total gains	1126.3560	1320.0382	1482.0366	1624.6256	1706.0245	1666.7489	1599.6621	1508.7585	1415.4875	1260.3409	1116.2148	1063.1366 (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	45.3642	45.5742	45.7861	46.8759	47.1001	47.7858	47.7858	47.7858	47.7858	47.1001	46.6538	46.2159
alpha	4.0243	4.0383	4.0524	4.1251	4.1400	4.1857	4.1857	4.1857	4.1857	4.1400	4.1103	4.0811
util living area	0.9915	0.9832	0.9651	0.9188	0.8227	0.6613	0.5029	0.5502	0.7725	0.9391	0.9841	0.9932 (86)
MIT	19.5093	19.7207	20.0326	20.4294	20.7415	20.9269	20.9817	20.9734	20.8562	20.4477	19.9172	19.4891 (87)
Th 2	19.9619	19.9662	19.9705	19.9920	19.9963	20.0093	20.0093	20.0093	20.0093	19.9963	19.9877	19.9791 (88)
util rest of house	0.9893	0.9790	0.9561	0.8973	0.7761	0.5799	0.3972	0.4428	0.7015	0.9185	0.9794	0.9915 (89)
MIT 2	17.9806	18.2899	18.7417	19.3152	19.7305	19.9537	20.0006	19.9956	19.8856	19.3536	18.5918	17.9626 (90)
Living area fraction	18.1632	18.4608	18.8959	19.4483	19.8513	20.0700	20.1178	20.1124	20.0015	19.4843	18.7501	18.1450 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1632	18.4608	18.8959	19.4483	19.8513	20.0700	20.1178	20.1124	20.0015	19.4843	18.7501	18.1450 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9837	0.9703	0.9437	0.8832	0.7685	0.5852	0.4092	0.4546	0.7009	0.9050	0.9711	0.9868 (94)
Ext temp.	1108.0292	1280.8385	1398.5273	1434.7964	1311.0210	975.3834	654.6138	685.8095	992.0950	1140.5988	1083.9752	1049.0796 (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)
	2758.6708	2686.0711	2443.9623	2031.3345	1562.2646	1033.3229	664.5469	701.2974	1114.8491	1702.7465	2254.2037	2723.8023 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	1228.0774	944.3163	777.8036	429.5075	186.9252	0.0000	0.0000	0.0000	0.0000	418.2379	842.5645	1245.9936 (98)
Space heating												6073.4261 (98)
Space heating per m2										(98) / (4) =		35.0336 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6703.5608 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1228.0774	944.3163	777.8036	429.5075	186.9252	0.0000	0.0000	0.0000	0.0000	418.2379	842.5645	1245.9936 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1355.4938	1042.2917	858.5029	474.0701	206.3192	0.0000	0.0000	0.0000	0.0000	461.6313	929.9829	1375.2689 (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	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (64)
Efficiency of water heater (217)m	88.7145	88.4917	88.0464	86.9845	84.8731	79.9000	79.9000	79.9000	79.9000	86.8329	88.2316	79.9000 (216)
Fuel for water heating, kWh/month	261.1389	230.9394	244.2163	222.2312	223.6684	213.0149	205.2625	224.2931	223.6013	230.8123	239.4042	254.8985 (219)
Water heating fuel used												2773.4813 (219)
Annual totals kWh/year												
Space heating fuel - main system												6703.5608 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)												
mechanical ventilation fans (SFP = 0.2681)												145.3896 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												220.3896 (231)
Electricity for lighting (calculated in Appendix L)												552.6704 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.36 * 1068 * 1.00) =										-1162.0607		-1162.0607 (233)
Total delivered energy for all uses												9088.0414 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6703.5608	3.4800	233.2839 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2773.4813	3.4800	96.5171 (247)
Mechanical ventilation fans	145.3896	13.1900	19.1769 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	552.6704	13.1900	72.8972 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1162.0607	13.1900	-153.2758 (252)
Total energy cost			398.4919 (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] =	0.7665 (257)
SAP value		89.3077
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6703.5608	0.2160	1447.9691 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2773.4813	0.2160	599.0720 (264)
Space and water heating			2047.0411 (265)
Pumps and fans	220.3896	0.5190	114.3822 (267)
Energy for lighting	552.6704	0.5190	286.8360 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-1162.0607	0.5190	-603.1095 (269)
Total kg/year			1845.1497 (272)
CO2 emissions per m2			10.6400 (273)
EI value			88.6770
EI rating			89 (274)
EI band			B

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8505 = 4.092$, stars = 4
Water heating environmental impact	$0.216 / 0.8505 = 0.2540$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												5.0000
Infiltration rate												0.2500 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2500 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000 (22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250 (22a)
Adj infilt rate												
	0.2875	0.2625	0.2563	0.2500	0.2625	0.2313	0.2438	0.2313	0.2313	0.2500	0.2438	0.2563 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5375	0.5125	0.5063	0.5000	0.5125	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5063 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			26.2600	1.3258	34.8144		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			87.7700	0.1200	10.5324	110.0000	9654.7000 (28a)					
External Walls	202.3200	34.0600	168.2600	0.1900	31.9694	60.0000	10095.6000 (29a)					
Pitched Cold Roof	85.5900		85.5900	0.1000	8.5590	9.0000	770.3100 (30)					
Bay Roof	2.1800		2.1800	0.1000	0.2180	9.0000	19.6200 (30)					
Total net area of external elements Aum(A, m2)			377.8600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.5192		(33)					
Internal Wall - Masonry			101.1700			75.0000	7587.7500 (32c)					
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)					
Internal Floor			85.5900			18.0000	1540.6200 (32d)					
Internal Ceiling			85.5900			18.0000	1540.6200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		32497.6600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.4577 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0491 (36)					
Total fabric heat loss						(33) + (36) =	115.5683 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 78.8402	Feb 75.1732	Mar 74.2565	Apr 73.3397	May 75.1732	Jun 73.3397	Jul 73.3397	Aug 73.3397	Sep 73.3397	Oct 73.3397	Nov 73.3397	Dec 74.2565 (38)
Heat transfer coeff	194.4085	190.7415	189.8248	188.9080	190.7415	188.9080	188.9080	188.9080	188.9080	188.9080	188.9080	189.8248 (39)
Average = Sum(39)m / 12 =												189.8248 (39)
HLP	Jan 1.1214	Feb 1.1003	Mar 1.0950	Apr 1.0897	May 1.1003	Jun 1.0897	Jul 1.0897	Aug 1.0897	Sep 1.0897	Oct 1.0897	Nov 1.0897	Dec 1.0950 (40)
HLP (average)												1.0950 (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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	115.1342	110.9475	106.7608	102.5741	98.3874	94.2007	94.2007	98.3874	102.5741	106.7608	110.9475	115.1342 (44)
Energy conte	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	25.6111	22.3996	23.1144	20.1517	19.3360	16.6855	15.4616	17.7424	17.9543	20.9240	22.8402	24.8030 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (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	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (64)
Heat gains from water heating, kWh/month	105.5132	93.6775	99.9789	91.8392	91.6035	84.1559	83.0151	88.0709	86.9683	95.1235	97.7987	103.7219 (65)
Total per year (kWh/year) = Sum(64)m =												2364.1980 (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	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.2362	69.4887	56.5120	42.7832	31.9810	26.9997	29.1741	37.9216	50.8983	64.6271	75.4294	80.4106 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	514.8672	520.2099	506.7465	478.0844	441.9036	407.8988	385.1815	379.8388	393.3022	421.9643	458.1451	492.1499 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694 (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)	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821 (71)
Water heating gains (Table 5)	141.8188	139.4010	134.3802	127.5545	123.1230	116.8832	111.5795	118.3749	120.7894	127.8542	135.8316	139.4111 (72)
Total internal gains	853.0327	847.2101	815.7491	766.5325	715.1179	669.8920	644.0455	654.2457	683.1003	732.5560	787.5164	830.0821 (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	
North	10.3100					14.6401	0.6300	0.7000	0.7700		46.1290 (74)	
East	6.5300					27.3735	0.6300	0.7000	0.7700		54.6279 (76)	
South	7.5600					61.3950	0.6300	0.7000	0.7700		141.8490 (78)	
West	1.8600					27.3735	0.6300	0.7000	0.7700		15.5602 (80)	
South	5.7000					61.3950	0.6300	0.7000	0.7700		106.9497 (78)	
Solar gains	365.1158	519.4118	732.3950	971.8857	1089.5464	1175.3463	1125.1775	1003.7575	858.6101	619.2020	420.9902	302.0074 (83)
Total gains	1218.1485	1366.6218	1548.1441	1738.4181	1804.6644	1845.2383	1769.2229	1658.0032	1541.7104	1351.7580	1208.5066	1132.0895 (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	46.4338	47.3265	47.5551	47.7858	47.3265	47.7858	47.7858	47.7858	47.7858	47.7858	47.7858	47.5551
alpha	4.0956	4.1551	4.1703	4.1857	4.1551	4.1857	4.1857	4.1857	4.1857	4.1857	4.1857	4.1703
util living area	0.9859	0.9768	0.9489	0.8746	0.7332	0.5139	0.3494	0.3612	0.6429	0.8872	0.9703	0.9885 (86)
MIT	19.7417	19.9185	20.2392	20.6053	20.8615	20.9766	20.9965	20.9961	20.9414	20.6570	20.1732	19.7532 (87)
Th 2	19.9834	20.0006	20.0049	20.0093	20.0006	20.0093	20.0093	20.0093	20.0093	20.0093	20.0093	20.0049 (88)
util rest of house	0.9822	0.9709	0.9358	0.8431	0.6701	0.4236	0.2460	0.2511	0.5511	0.8497	0.9612	0.9854 (89)
MIT 2	18.3327	18.5993	19.0595	19.5640	19.8746	19.9957	20.0083	20.0083	19.9692	19.6439	18.9749	18.3645 (90)
Living area fraction									fLA = Living area / (4) =			0.1195 (91)
MIT	18.5011	18.7569	19.2004	19.6883	19.9925	20.1129	20.1264	20.1263	20.0853	19.7649	19.1180	18.5304 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5011	18.7569	19.2004	19.6883	19.9925	20.1129	20.1264	20.1263	20.0853	19.7649	19.1180	18.5304 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9746	0.9610	0.9223	0.8312	0.6695	0.4334	0.2584	0.2643	0.5586	0.8386	0.9501	0.9788 (94)
Ext temp.	1187.2049	1313.2570	1427.8904	1445.0175	1208.2789	799.6656	457.1695	438.2099	861.2763	1133.6388	1148.1713	1108.0849 (95)
Heat loss rate W	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	2566.3999	2490.4908	2240.0101	1849.0980	1333.7529	814.7404	458.3611	439.4568	903.9855	1466.8552	2024.7224	2473.4938 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Month fraction	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	1026.1211	791.1011	604.2170	290.9380	93.3527	0.0000	0.0000	0.0000	0.0000	247.9130	631.1168	1015.8643 (98)
Space heating												4700.6241 (98)
Space heating per m2											(98) / (4) =	27.1148 (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 %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5188.3268 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1026.1211	791.1011	604.2170	290.9380	93.3527	0.0000	0.0000	0.0000	0.0000	247.9130	631.1168	1015.8643 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1132.5840	873.1800	666.9062	321.1236	103.0383	0.0000	0.0000	0.0000	0.0000	273.6347	696.5970	1121.2630 (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	231.6681	204.3621	215.0235	193.3068	189.8344	170.1989	164.0048	179.2102	178.6575	200.4209	211.2301	226.2807 (64)
Efficiency of water heater (217)m	88.4191	88.1758	87.5236	86.0024	83.1367	79.9000	79.9000	79.9000	79.9000	85.4825	87.6564	79.9000 (216)
Fuel for water heating, kWh/month	262.0115	231.7666	245.6748	224.7690	228.3401	213.0149	205.2625	224.2931	223.6013	234.4584	240.9752	255.8509 (219)
Water heating fuel used												2790.0183 (219)
Annual totals kWh/year												
Space heating fuel - main system												5188.3268 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)												
mechanical ventilation fans (SFP = 0.2681)												145.3896 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												220.3896 (231)
Electricity for lighting (calculated in Appendix L)												552.6704 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.36 * 1246 * 1.00) =									-1355.6655			-1355.6655 (233)
Total delivered energy for all uses												7395.7396 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5188.3268	3.6300	188.3363 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2790.0183	3.6300	101.2777 (247)
Mechanical ventilation fans	145.3896	19.4400	28.2637 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	552.6704	19.4400	107.4391 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1355.6655	19.4400	-263.5414 (252)
Total energy cost			271.3554 (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	5188.3268	0.2160	1120.6786 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2790.0183	0.2160	602.6440 (264)
Space and water heating			1723.3225 (265)
Pumps and fans	220.3896	0.5190	114.3822 (267)
Energy for lighting	552.6704	0.5190	286.8360 (268)
Energy saving/generation technologies			
PV Unit	-1355.6655	0.5190	-703.5904 (269)
Total kg/year			1420.9503 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
--	-----------------	----------------------------------	-------------------------

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - main system 1	5188.3268	1.2200	6329.7587 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2790.0183	1.2200	3403.8224 (264)
Space and water heating			9733.5810 (265)
Pumps and fans	220.3896	3.0700	676.5960 (267)
Energy for lighting	552.6704	3.0700	1696.6982 (268)
Energy saving/generation technologies			
PV Unit	-1355.6655	3.0700	-4161.8931 (269)
Primary energy kWh/year			7944.9821 (272)
Primary energy kWh/m ² /year			45.8294 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
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	-£ 42	-280 kg (19.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£42	1.62 kg/m ²	B 90
Total Savings	£42	1.62 kg/m ²	B 90

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

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
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	£150	£160	-£10
Mains gas	£385	£333	£51
Space heating	£326	£328	-£2
Water heating	£101	£58	£43
Lighting	£107	£107	£0
Generated (PV)	-£264	-£264	£0
Total cost of fuels	£271	£229	£41
Total cost of uses	£270	£229	£41
Delivered energy	43 kWh/m ²	35 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	1.1 tonnes	0.3 tonnes
CO2 emissions per m ²	8 kg/m ²	7 kg/m ²	2 kg/m ²
Primary energy	46 kWh/m ²	37 kWh/m ²	9 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (5)

2. Ventilation rate

										main heating	secondary heating	other	total	m3 per hour			
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.2500 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2500 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
	0.3188	0.3125	0.3063	0.2750	0.2688	0.2375	0.2375	0.2313	0.2500	0.2688	0.2813	0.2938 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5688	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5313	0.5438 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			26.2600	1.3258	34.8144		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			87.7700	0.1200	10.5324	110.0000	9654.7000 (28a)					
External Walls	202.3200	34.0600	168.2600	0.1900	31.9694	60.0000	10095.6000 (29a)					
Pitched Cold Roof	85.5900		85.5900	0.1000	8.5590	9.0000	770.3100 (30)					
Bay Roof	2.1800		2.1800	0.1000	0.2180	9.0000	19.6200 (30)					
Total net area of external elements Aum(A, m2)			377.8600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.5192		(33)					
Internal Wall - Masonry			101.1700			75.0000	7587.7500 (32c)					
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)					
Internal Floor			85.5900			18.0000	1540.6200 (32d)					
Internal Ceiling			85.5900			18.0000	1540.6200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		32497.6600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.4577 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0491 (36)					
Total fabric heat loss						(33) + (36) =	115.5683 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 83.4239	Feb 82.5072	Mar 81.5904	Apr 77.0067	May 76.0900	Jun 73.3397	Jul 73.3397	Aug 73.3397	Sep 73.3397	Oct 76.0900	Nov 77.9234	Dec 79.7569 (38)
Heat transfer coeff	198.9923	198.0755	197.1588	192.5750	191.6583	188.9080	188.9080	188.9080	188.9080	191.6583	193.4918	195.3253 (39)
Average = Sum(39)m / 12 =												192.8806 (39)
HLP	Jan 1.1479	Feb 1.1426	Mar 1.1373	Apr 1.1108	May 1.1056	Jun 1.0897	Jul 1.0897	Aug 1.0897	Sep 1.0897	Oct 1.1056	Nov 1.1161	Dec 1.1267 (40)
HLP (average)												1.1126 (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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	115.1342	110.9475	106.7608	102.5741	98.3874	94.2007	94.2007	98.3874	102.5741	106.7608	110.9475	115.1342 (44)
Energy conte	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)
Energy content (annual)										Total = Sum(45)m =		1646.8270 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.6111	22.3996	23.1144	20.1517	19.3360	16.6855	15.4616	17.7424	17.9543	20.9240	22.8402	24.8030 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss												
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												
	26.3655	23.8140	26.3655	25.5150	26.3655	25.5150	26.3655	26.3655	25.5150	26.3655	25.5150	26.3655 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	220.3686	194.1561	202.3283	175.6182	165.7406	146.6572	139.6783	155.8142	162.3196	187.7257	200.2951	214.9812 (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												1.1013 (H8)
Utilisation factor												0.5967 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.6675 (H14)
Volume ratio Veff/V												1.2181 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-951.5295 (H17)
Solar input	-27.5925	-46.0439	-78.4180	-105.0956	-129.8367	-127.6502	-125.9632	-110.0547	-86.1949	-58.8610	-32.7286	-23.0902 (63)
										Solar input (sum of months) = Sum(63)m =		-951.5295 (63)
Output from w/h												
	192.7762	148.1122	123.9103	70.5226	35.9038	19.0070	13.7151	45.7595	76.1247	128.8647	167.5665	191.8910 (64)
										Total per year (kWh/year) = Sum(64)m =		1214.1536 (64)
Heat gains from water heating, kWh/month												
	96.4736	85.5127	89.8227	77.6884	72.3284	65.3225	63.5540	69.3542	73.8980	84.9673	89.0507	94.6823 (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	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.2362	69.4887	56.5120	42.7832	31.9810	26.9997	29.1741	37.9216	50.8983	64.6271	75.4294	80.4106 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	514.8672	520.2099	506.7465	478.0844	441.9036	407.8988	385.1815	379.8388	393.3022	421.9643	458.1451	492.1499 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694 (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)	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821 (71)
Water heating gains (Table 5)	129.6688	127.2510	120.7294	107.9005	97.2156	90.7257	85.4220	93.2180	102.6362	114.2034	123.6816	127.2611 (72)
Total internal gains	840.8827	835.0601	802.0983	746.8785	689.2106	643.7346	617.8880	629.0888	664.9471	718.9052	775.3664	817.9321 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North					10.3100	10.6334		0.6300		0.7000	0.7700	33.5044 (74)
East					6.5300	19.6403		0.6300		0.7000	0.7700	39.1951 (76)
South					7.5600	46.7521		0.6300		0.7000	0.7700	108.0176 (78)
West					1.8600	19.6403		0.6300		0.7000	0.7700	11.1643 (80)
South					5.7000	46.7521		0.6300		0.7000	0.7700	81.4418 (78)
Solar gains	273.3233	472.8282	666.2875	858.0931	990.9066	996.8569	955.6166	854.5128	732.3872	527.7849	328.6984	233.0545 (83)
Total gains	1114.2060	1307.8882	1468.3858	1604.9716	1680.1172	1640.5915	1573.5046	1483.6015	1397.3343	1246.6901	1104.0648	1050.9866 (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	45.3642	45.5742	45.7861	46.8758	47.1001	47.7858	47.7858	47.7858	47.7858	47.1001	46.6538	46.2159
alpha	4.0243	4.0383	4.0524	4.1251	4.1400	4.1857	4.1857	4.1857	4.1857	4.1400	4.1103	4.0811
util living area												
	0.9918	0.9837	0.9661	0.9215	0.8285	0.6689	0.5104	0.5581	0.7781	0.9410	0.9847	0.9935 (86)
MIT	19.5014	19.7131	20.0247	20.4201	20.7336	20.9236	20.9807	20.9720	20.8520	20.4406	19.9095	19.4811 (87)
Th 2	19.9619	19.9662	19.9705	19.9920	19.9963	20.0093	20.0093	20.0093	20.0093	19.9963	19.9877	19.9791 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9897	0.9796	0.9574	0.9006	0.7826	0.5874	0.4035	0.4498	0.7076	0.9209	0.9801	0.9918 (89)
Living area fraction	17.9691	18.2790	18.7305	19.3027	19.7214	19.9510	20.0001	19.9947	19.8814	19.3441	18.5808	17.9510 (90)
MIT	18.1522	18.4503	18.8851	19.4362	19.8423	20.0672	20.1173	20.1115	fLA = Living area / (4) =			0.1195 (91)
Temperature adjustment									19.9973	19.4751	18.7395	18.1338 (92)
adjusted MIT	18.1522	18.4503	18.8851	19.4362	19.8423	20.0672	20.1173	20.1115	19.9973	19.4751	18.7395	0.0000
												18.1338 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9843	0.9711	0.9450	0.8864	0.7746	0.5926	0.4156	0.4615	0.7067	0.9075	0.9721	0.9873	(94)
Useful gains	1096.6850	1270.0944	1387.6716	1422.6059	1301.4637	972.1491	653.9181	684.7454	987.4645	1131.3452	1073.2083	1037.5990	(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	2756.4757	2683.9798	2441.8394	2029.0144	1560.5467	1032.7956	664.4374	701.1293	1114.0568	1700.9836	2252.1461	2721.6176	(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	1234.8843	950.1310	784.3009	436.6141	192.7577	0.0000	0.0000	0.0000	0.0000	423.8109	848.8352	1252.9098	(98)
Space heating												6124.2439	(98)
Space heating per m2												(98) / (4) =	35.3267 (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 %)	90.6000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	6759.6511 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1234.8843	950.1310	784.3009	436.6141	192.7577	0.0000	0.0000	0.0000	0.0000	423.8109	848.8352	1252.9098	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	1363.0069	1048.7097	865.6743	481.9140	212.7569	0.0000	0.0000	0.0000	0.0000	467.7825	936.9042	1382.9027	(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	192.7762	148.1122	123.9103	70.5226	35.9038	19.0070	13.7151	45.7595	76.1247	128.8647	167.5665	191.8910	(64)
Efficiency of water heater (217)m	88.9908	88.9927	88.9744	88.9436	88.7342	79.9000	79.9000	79.9000	79.9000	87.8567	88.6429	79.9000	(216)
Fuel for water heating, kWh/month	216.6248	166.4318	139.2652	79.2891	40.4623	23.7885	17.1653	57.2710	95.2749	146.6760	189.0353	215.5673	(219)
Water heating fuel used												1386.8515	(219)
Annual totals kWh/year													
Space heating fuel - main system												6759.6511	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:		
(MEV)Decentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)		
mechanical ventilation fans (SFP = 0.2681)		145.3896 (230a)
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		270.3896 (231)
Electricity for lighting (calculated in Appendix L)		552.6704 (232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.36 * 1068 * 1.00) =	-1162.0607	-1162.0607 (233)
Total delivered energy for all uses		7807.5020 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6759.6511	3.4800	235.2359	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1386.8515	3.4800	48.2624	(247)
Mechanical ventilation fans	145.3896	13.1900	19.1769	(249)
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	552.6704	13.1900	72.8972	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1162.0607	13.1900	-153.2758	(252)
Total energy cost			358.7841	(255)

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.6901 (257)
SAP value		90.3732
SAP rating (Section 12)		90 (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	6759.6511	0.2160	1460.0846 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1386.8515	0.2160	299.5599 (264)
Space and water heating			1759.6446 (265)
Pumps and fans	270.3896	0.5190	140.3322 (267)
Energy for lighting	552.6704	0.5190	286.8360 (268)
Energy saving/generation technologies			
PV Unit	-1162.0607	0.5190	-603.1095 (269)
Total kg/year			1583.7032 (272)
CO2 emissions per m2			9.1400 (273)
EI value			90.2814
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	87.7700 (1b)	x 2.4800 (2b)	= 217.6696 (1b) - (3b)
First floor	85.5900 (1c)	x 2.6500 (2c)	= 226.8135 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	173.3600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 444.4831 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											5.0000	
Infiltration rate											0.2500 (18)	
Number of sides sheltered											0 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2500 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000 (22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250 (22a)
Adj infilt rate	0.2875	0.2625	0.2563	0.2500	0.2625	0.2313	0.2438	0.2313	0.2313	0.2500	0.2438	0.2563 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5375	0.5125	0.5063	0.5000	0.5125	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5063 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			26.2600	1.3258	34.8144		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			87.7700	0.1200	10.5324	110.0000	9654.7000 (28a)					
External Walls	202.3200	34.0600	168.2600	0.1900	31.9694	60.0000	10095.6000 (29a)					
Pitched Cold Roof	85.5900		85.5900	0.1000	8.5590	9.0000	770.3100 (30)					
Bay Roof	2.1800		2.1800	0.1000	0.2180	9.0000	19.6200 (30)					
Total net area of external elements Aum(A, m2)			377.8600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		97.5192		(33)					
Internal Wall - Masonry			101.1700			75.0000	7587.7500 (32c)					
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)					
Internal Floor			85.5900			18.0000	1540.6200 (32d)					
Internal Ceiling			85.5900			18.0000	1540.6200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		32497.6600 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							187.4577 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.0491 (36)					
Total fabric heat loss						(33) + (36) =	115.5683 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 78.8402	Feb 75.1732	Mar 74.2565	Apr 73.3397	May 75.1732	Jun 73.3397	Jul 73.3397	Aug 73.3397	Sep 73.3397	Oct 73.3397	Nov 73.3397	Dec 74.2565 (38)
Heat transfer coeff	194.4085	190.7415	189.8248	188.9080	190.7415	188.9080	188.9080	188.9080	188.9080	188.9080	188.9080	189.8248 (39)
Average = Sum(39)m / 12 =												189.8248 (39)
HLP	Jan 1.1214	Feb 1.1003	Mar 1.0950	Apr 1.0897	May 1.1003	Jun 1.0897	Jul 1.0897	Aug 1.0897	Sep 1.0897	Oct 1.0897	Nov 1.0897	Dec 1.0950 (40)
HLP (average)												1.0950 (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												2.9671 (42)
Average daily hot water use (litres/day)												104.6675 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	115.1342	110.9475	106.7608	102.5741	98.3874	94.2007	94.2007	98.3874	102.5741	106.7608	110.9475	115.1342 (44)
Energy conte	170.7407	149.3309	154.0961	134.3448	128.9070	111.2369	103.0774	118.2828	119.6955	139.4935	152.2681	165.3533 (45)
Energy content (annual)										Total = Sum(45)m =		1646.8270 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.6111	22.3996	23.1144	20.1517	19.3360	16.6855	15.4616	17.7424	17.9543	20.9240	22.8402	24.8030 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss												
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												
	26.3655	23.8140	26.3655	25.5150	26.3655	25.5150	26.3655	26.3655	25.5150	26.3655	25.5150	26.3655 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	220.3686	194.1561	202.3283	175.6182	165.7406	146.6572	139.6783	155.8142	162.3196	187.7257	200.2951	214.9812 (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												1269.6808 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2133.0637 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2953 (H8)
Utilisation factor												0.5379 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.6675 (H14)
Volume ratio Veff/V												1.2181 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-1008.9432 (H17)
Solar input	-33.9804	-46.6319	-79.2256	-108.6636	-129.5609	-136.2616	-134.4125	-117.7066	-92.6506	-63.6215	-38.6513	-27.5767 (63)
								Solar input (sum of months) = Sum(63)m =				-1008.9432 (63)
Output from w/h												
	186.3882	147.5243	123.1027	66.9546	36.1797	10.3956	5.2658	38.1076	69.6689	124.1041	161.6438	187.4044 (64)
								Total per year (kWh/year) = Sum(64)m =				1156.7399 (64)
Heat gains from water heating, kWh/month												
	96.4736	85.5127	89.8227	77.6884	72.3284	65.3225	63.5540	69.3542	73.8980	84.9673	89.0507	94.6823 (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	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	178.0231	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.2362	69.4887	56.5120	42.7832	31.9810	26.9997	29.1741	37.9216	50.8983	64.6271	75.4294	80.4106	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	514.8672	520.2099	506.7465	478.0844	441.9036	407.8988	385.1815	379.8388	393.3022	421.9643	458.1451	492.1499	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	55.7694	(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)	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	-118.6821	(71)
Water heating gains (Table 5)	129.6688	127.2510	120.7294	107.9005	97.2156	90.7257	85.4220	93.2180	102.6362	114.2034	123.6816	127.2611	(72)
Total internal gains	840.8827	835.0601	802.0983	746.8785	689.2106	643.7346	617.8880	629.0888	664.9471	718.9052	775.3664	817.9321	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data Table 6c		Access factor Table 6d		Gains W	
North				10.3100	14.6401		0.6300		0.7000		0.7700		46.1290 (74)	
East				6.5300	27.3735		0.6300		0.7000		0.7700		54.6279 (76)	
South				7.5600	61.3950		0.6300		0.7000		0.7700		141.8490 (78)	
West				1.8600	27.3735		0.6300		0.7000		0.7700		15.5602 (80)	
South				5.7000	61.3950		0.6300		0.7000		0.7700		106.9497 (78)	
Solar gains	365.1158	519.4118	732.3950	971.8857	1089.5464	1175.3463	1125.1775	1003.7575	858.6101	619.2020	420.9902	302.0074	(83)	
Total gains	1205.9985	1354.4718	1534.4933	1718.7641	1778.7570	1819.0808	1743.0655	1632.8463	1523.5572	1338.1072	1196.3566	1119.9395	(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	46.4338	47.3265	47.5551	47.7858	47.3265	47.7858	47.7858	47.7858	47.7858	47.7858	47.7858	47.5551
alpha	4.0956	4.1551	4.1703	4.1857	4.1551	4.1857	4.1857	4.1857	4.1857	4.1857	4.1857	4.1703
util living area												
	0.9864	0.9775	0.9503	0.8781	0.7398	0.5204	0.3545	0.3666	0.6487	0.8901	0.9713	0.9889 (86)
MIT	19.7340	19.9110	20.2318	20.5976	20.8566	20.9755	20.9963	20.9959	20.9394	20.6514	20.1659	19.7453 (87)
Th 2	19.9834	20.0006	20.0049	20.0093	20.0006	20.0093	20.0093	20.0093	20.0093	20.0093	20.0093	20.0049 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT 2	0.9828	0.9718	0.9375	0.8472	0.6771	0.4293	0.2497	0.2550	0.5567	0.8533	0.9624	0.9859 (89)
Living area fraction	18.3216	18.5886	19.0492	19.5543	19.8696	19.9950	20.0083	20.0082	19.9677	19.6370	18.9647	18.3531 (90)
MIT	18.4903	18.7466	19.1905	19.6790	19.9875	20.1122	20.1263	20.1262	fLA = Living area / (4) =			0.1195 (91)
Temperature adjustment									20.0837	19.7582	19.1082	18.5194 (92)
adjusted MIT	18.4903	18.7466	19.1905	19.6790	19.9875	20.1122	20.1263	20.1262	20.0837	19.7582	19.1082	0.0000
												18.5194 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9754	0.9620	0.9241	0.8351	0.6762	0.4391	0.2622	0.2683	0.5641	0.8420	0.9515	0.9795 (94)	
Useful gains	1176.2844	1302.9374	1417.9816	1435.3587	1202.7072	798.7734	457.0859	438.1202	859.4384	1126.7092	1138.3018	1096.9878 (95)	
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000 (96)	
Heat loss rate W	2564.3093	2488.5311	2238.1290	1847.3265	1332.8040	814.6003	458.3474	439.4420	903.6888	1465.5826	2022.8579	2471.4132 (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	1032.6905	796.7189	610.1897	296.6169	96.7920	0.0000	0.0000	0.0000	0.0000	252.1218	636.8803	1022.5725 (98)	
Space heating												4744.5827 (98)	
Space heating per m2												(98) / (4) =	27.3684 (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 %)	90.6000 (206)
Efficiency of secondary/supplementary heating system, %	0.0000 (208)
Space heating requirement	5236.8462 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1032.6905	796.7189	610.1897	296.6169	96.7920	0.0000	0.0000	0.0000	0.0000	252.1218	636.8803	1022.5725 (98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)	
Space heating fuel (main heating system)	1139.8350	879.3807	673.4986	327.3917	106.8344	0.0000	0.0000	0.0000	0.0000	278.2801	702.9584	1128.6672 (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													
Water heating requirement	186.3882	147.5243	123.1027	66.9546	36.1797	10.3956	5.2658	38.1076	69.6689	124.1041	161.6438	187.4044 (64)	
Efficiency of water heater (217)m	88.7822	88.7433	88.6080	88.4194	87.4149	79.9000	79.9000	79.9000	79.9000	86.7671	88.2088	79.9000 (216)	
Fuel for water heating, kWh/month	209.9388	166.2372	138.9296	75.7238	41.3885	13.0107	6.5905	47.6942	87.1952	143.0314	183.2514	211.1385 (219)	
Water heating fuel used												1324.1298 (219)	
Annual totals kWh/year													
Space heating fuel - main system												5236.8462 (211)	
Space heating fuel - secondary												0.0000 (215)	

Electricity for pumps and fans:		
(MEV)Decentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)		
mechanical ventilation fans (SFP = 0.2681)		145.3896 (230a)
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		270.3896 (231)
Electricity for lighting (calculated in Appendix L)		552.6704 (232)

Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 1.36 * 1246 * 1.00) =	-1355.6655	-1355.6655 (233)
Total delivered energy for all uses		6028.3705 (238)

10a. Fuel costs - using BEDF prices (495)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5236.8462	3.6300	190.0975 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1324.1298	3.6300	48.0659 (247)	
Mechanical ventilation fans	145.3896	19.4400	28.2637 (249)	
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)	
Pump for solar water heating	50.0000	19.4400	9.7200 (249)	
Energy for lighting	552.6704	19.4400	107.4391 (250)	
Additional standing charges			95.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1355.6655	19.4400	-263.5414 (252)	
Total energy cost			229.6249 (255)	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5236.8462	0.2160	1131.1588 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1324.1298	0.2160	286.0120 (264)
Space and water heating			1417.1708 (265)
Pumps and fans	270.3896	0.5190	140.3322 (267)
Energy for lighting	552.6704	0.5190	286.8360 (268)
Energy saving/generation technologies			
PV Unit	-1355.6655	0.5190	-703.5904 (269)
Total kg/year			1140.7486 (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	5236.8462	1.2200	6388.9524 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1324.1298	1.2200	1615.4384 (264)
Space and water heating			8004.3907 (265)
Pumps and fans	270.3896	3.0700	830.0960 (267)
Energy for lighting	552.6704	3.0700	1696.6982 (268)
Energy saving/generation technologies			
PV Unit	-1355.6655	3.0700	-4161.8931 (269)
Primary energy kWh/year			6369.2918 (272)
Primary energy kWh/m2/year			36.7403 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	187.5 (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	1173.44 (P1)
Transmission heat loss coefficient	115.57 (P7)
Summer heat loss coefficient	1289.00 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	10.3100	87.1704	0.6300	0.7000	0.9000	321.0344
East	6.5300	125.2818	0.6300	0.7000	0.9000	292.2299
South	7.5600	118.5567	0.6300	0.7000	0.9000	320.1632
West	1.8600	125.2818	0.6300	0.7000	0.9000	83.2385
South	5.7000	118.5567	0.6300	0.7000	0.9000	241.3929
total:						1258.0589

Solar gains	Jun 1346	Jul 1258	Aug 1144	(P3)
Internal gains	667	641	651	
Total summer gains	2013	1899	1795	(P5)
Summer gain/loss ratio	1.56	1.47	1.39	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 187.5)	0.69	0.69	0.69	
Threshold temperature	17.65	19.46	19.38	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Assessment of likelihood of high internal temperature:

Not significant

PREDICTED ENERGY ASSESSMENT

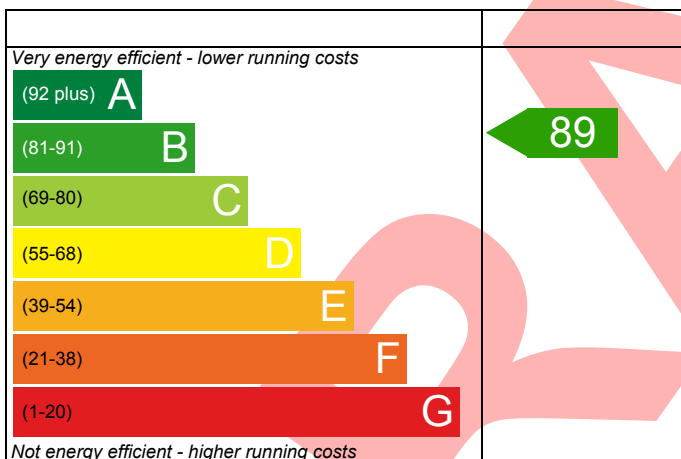
Plot 1, Long Copse Lane,
Emsworth,
Hampshire,
PO10 7UR

Dwelling type: House, Detached
Date of assessment: 10/05/2022
Produced by: Scott Spearing
Total floor area: 173.36 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO₂) emissions.

Energy Efficiency Rating

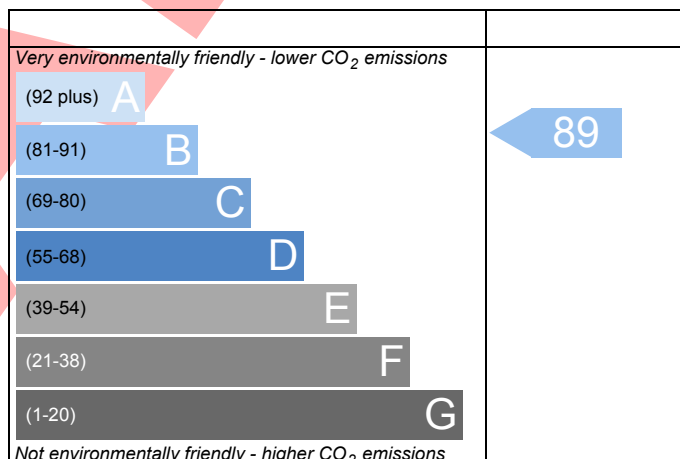


England

EU Directive
2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO₂) Rating



England

EU Directive
2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO₂) emissions. The higher the rating the less impact it has on the environment.

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.