



SAP Report Submission for Building Regulations Compliance

Client: Metis Build Ltd

Project: Plot 4, Long Copse Lane
Emsworth, Hampshire, PO10 7UR

Contact: Scott Spearing
Scott Spearing
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 4			Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref			
Property	Plot 4, Long Copse Lane, Emsworth, Hampshire, PO10 7UR				
SAP Rating	88 B	DER	13.77	TER	17.24
Environmental	89 B	% DER<TER	20.13		
CO ₂ Emissions (t/year)	0.92	DFEE	46.69	TFEE	51.47
General Requirements Compliance	Pass	% DFEE<TFEE	9.29		
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 TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	17.24	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	13.77	kgCO ₂ /m ²	Pass
	-3.47 (-20.1%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	51.47	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	46.69	kWh/m ² /yr	
	-4.8 (-9.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	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	1.45 (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

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Main heating system

Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoTEC sustain 28 VUW 286/7-2 (H-GB)
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0%

Pass

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Programmer, room thermostat and TRVs

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100 %

Minimum

75 %

Pass

8 Mechanical ventilation

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

6.39 m², No overhang

Windows facing East

3.00 m², No overhang

Windows facing South

8.55 m², No overhang

Windows facing West

0.90 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

10 Key features

Party wall U-value	0.00	W/m ² K
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	0.76	kW

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

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

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Semi-Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	1
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	21.07 m	49.29 m ²	2.48 m
1st Storey:	19.56 m	47.79 m ²	2.65 m

7.0 Living Area 17.79 m²

8.0 Thermal Mass Parameter
Thermal Mass 214.71 kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.19	60.00	104.09	83.15

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Wall	Filled Cavity with Edge Sealing	Single plasterboard on dabs both sides, lightweight aggregate blocks, cavity or cavity fill	0.00	110.00	48.22

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - Masonry	Dense block, plasterboard on dabs	75.00	54.35
Internal Wall - Timber	Plasterboard on timber frame	9.00	68.25

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Gross Area (m²)	Nett Area (m²)
Pitched Cold Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	47.79	47.79
Bay Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	1.50	1.50

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	47.79

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	49.29

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	47.79

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
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					6.39	
Side Elevation	Window	[1] External Walls	East	None	0.00					3.00	
Rear French Doors	Window	[1] External Walls	South	None	0.00					5.67	
Rear Elevation	Window	[1] External Walls	South	None	0.00					2.88	
Side Elevation	Window	[1] External Walls	West	None	0.00					0.90	

14.0 Conservatory

None

15.0 Draught Proofing

100 %

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	13.93	0.050	Yes	Hi-Therms
Table K1 - Approved	E3 Sill	12.93	0.040	Yes	
Table K1 - Approved	E4 Jamb	28.20	0.050	No	
Table K1 - Approved	E5 Ground floor (normal)	21.07	0.160	Yes	
Table K1 - Approved	E6 Intermediate floor within a dwelling	19.56	0.070	Yes	
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	22.31	0.060	No	
Table K1 - Approved	E12 Gable (insulation at ceiling level)	0.75	0.240	No	
Table K1 - Approved	E16 Corner (normal)	15.20	0.090	No	
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	4.95	-0.090	No	
Table K1 - Approved	E18 Party wall between dwellings	10.26	0.060	Yes	
Table K1 - Default	P1 Party wall - Ground floor	9.40	0.160	No	
Table K1 - Default	P2 Party wall - Intermediate floor within a dwelling	9.40	0.000	No	
Table K1 - Default	P4 Party wall - Roof (insulation at ceiling level)	9.40	0.240	No	

Y-value	0.070	W/m²K
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18.0 Pressure Testing	Yes	
Designed AP ₅₀	5.00	m³/(h.m²) @ 50 Pa
Property Tested ?		
As Built AP ₅₀		m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation	
Summer Overheating	
Windows open in hot weather	Windows fully open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	8.00
Mechanical Ventilation	
Mechanical Ventilation System Present	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	3

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
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SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

	Database	
Description	Gas Boiler	
Percentage of Heat	100	%
Database Ref. No.	18119	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.0	
In Summer	87.0	
Controls	CBE Programmer, room thermostat and TRVs	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2106	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	

25.0 Main Heating 2

None

Community Heating	None
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28.0 Water Heating

	HWP From main heating 1	
Water Heating	Main Heating 1	
Flue Gas Heat Recovery System	No	
Waste Water Heat Recovery Instantaneous System 1	No	
Waste Water Heat Recovery Instantaneous System 2	No	
Waste Water Heat Recovery Storage System	No	
Solar Panel	No	
Water use <= 125 litres/person/day	Yes	
SAP Code	901	

29.0 Hot Water Cylinder

None

32.0 Photovoltaic Unit

One Dwelling

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

PV Cells kWp 0.76	Orientation South	Elevation 45°	Overshading None Or Little	Connected to Dwelling Yes
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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	£28	B 89	

U-VALUE CALCULATOR REPORT

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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

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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

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Client	Metis Build Ltd, METIS BUILD
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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

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Building Elements

Floor Ground Floor

Floor Type: Suspended Floor

Area = 49.29 m², Perimeter = 21.07 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	Blockwork, dense				
	Main construction	100	1.5900	0.0629	82.95
	Main construction	100	2.3000	0.0435	17.05
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 = 7.283 m² K/W Lower limit = 7.282 m² K/W Average = 7.282 m² K/W

Total correction = 0.0088 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 325 mm

U-value: 0.12 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 97 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) 17.24 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.77 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.5 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	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	1.45 (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 sustain 28 VUW 286/7-2 (H-GB)

Combi boiler

Efficiency: 89.1% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

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: 6.39 m², No overhang

Windows facing East: 3.00 m², No overhang

Windows facing South: 8.55 m², No overhang

Windows facing West: 0.90 m², No overhang

Air change rate: 8.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.10 W/m²K

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Photovoltaic array 0.76 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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2313 (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)
	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:	0.5000 (23a)											
Effective ac	0.5448	0.5391	0.5333	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5102	0.5217 (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)			13.1700	1.3258	17.4602		(27)					
French Doors (Uw = 1.50)			5.6700	1.4151	8.0236		(27)					
Ground Floor			49.2900	0.1200	5.9148	75.0000	3696.7500 (28a)					
External Walls	104.0900	20.9400	83.1500	0.1900	15.7985	60.0000	4989.0000 (29a)					
Pitched Cold Roof	47.7900		47.7900	0.1000	4.7790	9.0000	430.1100 (30)					
Bay Roof	1.5000		1.5000	0.1000	0.1500	9.0000	13.5000 (30)					
Total net area of external elements Aum(A, m2)			202.6700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4861			(33)					
Party Wall			48.2200	0.0000	0.0000	110.0000	5304.2000 (32)					
Internal Wall - Masonry			54.3500			75.0000	4076.2500 (32c)					
Internal Wall - Timber			68.2500			9.0000	614.2500 (32c)					
Internal Floor			47.7900			18.0000	860.2200 (32d)					
Internal Ceiling			47.7900			18.0000	860.2200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	20844.5000 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							214.7147 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1808 (36)					
Total fabric heat loss					(33) + (36) =	69.6669 (37)						
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.7487	Feb 44.2739	Mar 43.7991	Apr 41.4250	May 41.0656	Jun 41.0656	Jul 41.0656	Aug 41.0656	Sep 41.0656	Oct 41.0656	Nov 41.8998	Dec 42.8494 (38)
Heat transfer coeff	114.4156	113.9408	113.4660	111.0919	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	111.5667	112.5163 (39)
Average = Sum(39)m / 12 =												111.7827 (39)
HLP	Jan 1.1786	Feb 1.1737	Mar 1.1688	Apr 1.1443	May 1.1406	Jun 1.1406	Jul 1.1406	Aug 1.1406	Sep 1.1406	Oct 1.1406	Nov 1.1492	Dec 1.1590 (40)
HLP (average)												1.1514 (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	2.7108 (42)
Average daily hot water use (litres/day)	98.5815 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397	(44)
Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387	(45)
Energy content (annual)	Total = Sum (45)m = 1551.0710												(45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	18.8122	16.9451	18.6538	17.8682	18.3243	17.5723	18.0579	18.2306	17.7335	18.5149	18.0820	18.7609	(61)
Total heat required for water heating calculated for each month	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(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	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(64)
Heat gains from water heating, kWh/month	58.1733	51.0017	52.9212	46.5393	44.9504	39.2288	36.7949	41.5999	41.9180	48.3134	52.2058	56.4733	(65)
Total per year (kWh/year) = Sum(64)m =	1768.6268												(64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	(66)
(66)m	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.6584	20.1250	16.3668	12.3907	9.2622	7.8195	8.4493	10.9827	14.7409	18.7170	21.8455	23.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.5189	254.1289	247.5518	233.5500	215.8753	199.2635	188.1658	185.5559	192.1329	206.1347	223.8095	240.4212	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	78.1900	75.8954	71.1307	64.6379	60.4172	54.4844	49.4555	55.9138	58.2194	64.9374	72.5080	75.9050	(72)
Total internal gains	419.0293	416.8114	401.7113	377.2407	352.2167	328.2295	312.7326	319.1144	331.7553	356.4511	384.8250	406.2764	(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				6.3900	10.6334	0.6300	0.7000	0.7700	20.7656 (74)				
East				3.0000	19.6403	0.6300	0.7000	0.7700	18.0070 (76)				
South				2.8800	46.7521	0.6300	0.7000	0.7700	41.1496 (78)				
West				0.9000	19.6403	0.6300	0.7000	0.7700	5.4021 (80)				
South				5.6700	46.7521	0.6300	0.7000	0.7700	81.0132 (78)				
Solar gains	166.3374	285.5483	397.7027	506.3441	580.8611	583.0470	559.4357	502.6320	435.0129	317.3715	199.6099	142.1215	(83)
Total gains	585.3667	702.3596	799.4140	883.5847	933.0778	911.2765	872.1683	821.7463	766.7682	673.8227	584.4349	548.3980	(84)

7. Mean internal temperature (heating season)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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)													
tau	50.6062	50.8171	51.0297	52.1203	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	51.8984	51.4604	
alpha	4.3737	4.3878	4.4020	4.4747	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4599	4.4307	
util living area	0.9961	0.9908	0.9781	0.9417	0.8556	0.7029	0.5398	0.5901	0.8163	0.9604	0.9919	0.9970	(86)
MIT	19.5627	19.7662	20.0635	20.4417	20.7475	20.9256	20.9820	20.9733	20.8493	20.4496	19.9424	19.5398	(87)
Th 2	19.9372	19.9411	19.9451	19.9648	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9608	19.9529	(88)
util rest of house	0.9949	0.9881	0.9715	0.9232	0.8099	0.6154	0.4221	0.4713	0.7443	0.9442	0.9891	0.9962	(89)
MIT 2	18.6308	18.8360	19.1326	19.5140	19.7934	19.9311	19.9626	19.9593	19.8816	19.5302	19.0278	18.6202	(90)
Living area fraction	18.8016	19.0065	19.3032	19.6840	19.9682	20.1134	20.1494	20.1451	20.0589	19.6987	19.1954	18.7887	(91)
MIT	18.8016	19.0065	19.3032	19.6840	19.9682	20.1134	20.1494	20.1451	20.0589	19.6987	19.1954	18.7887	(92)
Temperature adjustment													0.0000
adjusted MIT	18.8016	19.0065	19.3032	19.6840	19.9682	20.1134	20.1494	20.1451	20.0589	19.6987	19.1954	18.7887	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9932	0.9849	0.9662	0.9171	0.8099	0.6287	0.4436	0.4928	0.7516	0.9388	0.9863	0.9948	(94)
Useful gains	581.3757	691.7781	772.4138	810.3696	755.6850	572.9205	386.9125	404.9170	576.2659	632.5613	576.4187	545.5534	(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	1659.2061	1607.3053	1452.7293	1198.0189	915.5621	610.5080	393.0346	414.7035	659.8426	1007.5185	1349.4408	1641.4701	(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	801.9058	615.2342	506.1547	279.1075	118.9485	0.0000	0.0000	0.0000	0.0000	278.9682	556.5759	815.3621	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Space heating
Space heating per m2 (98) / (4) = 3972.2570 (98)
40.9174 (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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4413.6189 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	801.9058	615.2342	506.1547	279.1075	118.9485	0.0000	0.0000	0.0000	0.0000	278.9682	556.5759	815.3621	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	891.0065	683.5936	562.3941	310.1195	132.1650	0.0000	0.0000	0.0000	0.0000	309.9646	618.4177	905.9578	(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	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(64)
Efficiency of water heater	89.4356	89.3716	89.2476	88.9541	88.3542	87.0000	87.0000	87.0000	87.0000	88.9282	89.3074	89.4562	(216)
(217)m	89.4356	89.3716	89.2476	88.9541	88.3542	87.0000	87.0000	87.0000	87.0000	88.9282	89.3074	89.4562	(217)
Fuel for water heating, kWh/month	200.8429	176.3347	183.5231	162.3324	158.1541	140.6222	132.3469	149.0066	149.9646	168.5601	180.8320	195.0671	(219)
Water heating fuel used												1997.5866	(219)
Annual totals kWh/year													
Space heating fuel - main system												4413.6189	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.0340, total flow = 37.0000, SFP = 0.2712)													
mechanical ventilation fans (SFP = 0.2712)												82.3430	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												157.3430	(231)
Electricity for lighting (calculated in Appendix L)												400.1551	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.76 * 1068 * 1.00) =											-649.3869	-649.3869	(233)
Total delivered energy for all uses												6319.3168	(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	4413.6189	0.2160	953.3417	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1997.5866	0.2160	431.4787	(264)
Space and water heating			1384.8204	(265)
Pumps and fans	157.3430	0.5190	81.6610	(267)
Energy for lighting	400.1551	0.5190	207.6805	(268)
Energy saving/generation technologies				
PV Unit	-649.3869	0.5190	-337.0318	(269)
Total CO2, kg/year			1337.1302	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7700	(273)

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

DER	13.7700	ZC1
Total Floor Area	97.0800	
Assumed number of occupants	2.7108	
CO2 emission factor in Table 12 for electricity displaced from grid	0.5190	
CO2 emissions from appliances, equation (L14)	15.3528	ZC2
CO2 emissions from cooking, equation (L16)	1.8960	ZC3
Total CO2 emissions	31.0187	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	31.0187	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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1205 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3705 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3427 (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	0.4370	0.4284	0.4199	0.3770	0.3685	0.3256	0.3256	0.3170	0.3427	0.3685	0.3856	0.4027 (22b)
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (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)			18.8400	1.3258	24.9773		(27)
Ground Floor			49.2900	0.1300	6.4077		(28a)
External Walls	104.0900	20.9400	83.1500	0.1800	14.9670		(29a)
Pitched Cold Roof	47.7900		47.7900	0.1300	6.2127		(30)
Bay Roof	1.5000		1.5000	0.1300	0.1950		(30)
Total net area of external elements Aum(A, m ²)			202.6700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.8597	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9259 (36)
Total fabric heat loss						(33) + (36) =	65.7856 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.9081	48.6035	48.3050	46.9030	46.6407	45.4195	45.4195	45.1934	45.8899	46.6407	47.1713	47.7261 (38)
Heat transfer coeff	114.6936	114.3891	114.0906	112.6886	112.4262	111.2051	111.2051	110.9790	111.6755	112.4262	112.9569	113.5117 (39)
Average = Sum(39)m / 12 =												112.6873 (39)
HLP	1.1814	1.1783	1.1752	1.1608	1.1581	1.1455	1.1455	1.1432	1.1503	1.1581	1.1635	1.1693 (40)
HLP (average)												1.1608 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)
Energy content (annual)	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 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	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	47.6432	47.2219	43.7540	45.2125	47.2219	47.6432	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	211.7718	186.6754	196.0950	174.1764	168.6335	148.5230	142.2963	158.6270	160.3789	182.3415	192.7294	206.6976 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	211.7718	186.6754	196.0950	174.1764	168.6335	148.5230	142.2963	158.6270	160.3789	182.3415	192.7294	206.6976 (64)
Heat gains from water heating, kWh/month	66.2100	58.2723	60.9975	53.9831	52.1748	45.7742	43.5835	48.8477	49.3954	56.4244	60.0140	64.5228 (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	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.6584	20.1250	16.3668	12.3907	9.2622	7.8195	8.4493	10.9827	14.7409	18.7170	21.8455	23.2882 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.5189	254.1289	247.5518	233.5500	215.8753	199.2635	188.1658	185.5559	192.1329	206.1347	223.8095	240.4212 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540 (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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320 (71)
Water heating gains (Table 5)	88.9919	86.7147	81.9859	74.9765	70.1275	63.5753	58.5800	65.6555	68.6047	75.8393	83.3528	86.7242 (72)
Total internal gains	429.8313	427.6306	412.5665	387.5792	361.9269	337.3203	321.8571	328.8560	342.1406	367.3530	395.6698	417.0957 (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					6.3900	10.6334	0.6300	0.7000			0.7700	20.7656 (74)
East					3.0000	19.6403	0.6300	0.7000			0.7700	18.0070 (76)
South					8.5500	46.7521	0.6300	0.7000			0.7700	122.1627 (78)
West					0.9000	19.6403	0.6300	0.7000			0.7700	5.4021 (80)

Solar gains	166.3374	285.5483	397.7027	506.3441	580.8611	583.0470	559.4357	502.6320	435.0129	317.3715	199.6099	142.1215 (83)
Total gains	596.1687	713.1789	810.2692	893.9233	942.7881	920.3673	881.2928	831.4880	777.1535	684.7245	595.2797	559.2172 (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	58.7798	58.9363	59.0905	59.8257	59.9652	60.6237	60.6237	60.7472	60.3684	59.9652	59.6835	59.3918
alpha	4.9187	4.9291	4.9394	4.9884	4.9977	5.0416	5.0416	5.0498	5.0246	4.9977	4.9789	4.9595
util living area	0.9978	0.9943	0.9848	0.9544	0.8732	0.7125	0.5421	0.5927	0.8304	0.9702	0.9950	0.9984 (86)
MIT	19.7298	19.9100	20.1753	20.5073	20.7853	20.9458	20.9888	20.9829	20.8789	20.5123	20.0564	19.6998 (87)
Th 2	19.9349	19.9374	19.9399	19.9515	19.9537	19.9638	19.9638	19.9657	19.9599	19.9537	19.9493	19.9447 (88)
util rest of house	0.9970	0.9923	0.9793	0.9374	0.8266	0.6205	0.4212	0.4700	0.7551	0.9558	0.9930	0.9978 (89)
MIT 2	18.2459	18.5103	18.8964	19.3754	19.7434	19.9278	19.9598	19.9587	19.8642	19.3918	18.7333	18.2091 (90)
Living area fraction									fLA = Living area / (4) =			0.1833 (91)
MIT	18.5178	18.7668	19.1307	19.5828	19.9343	20.1143	20.1483	20.1464	20.0502	19.5971	18.9758	18.4823 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5178	18.7668	19.1307	19.5828	19.9343	20.1143	20.1483	20.1464	20.0502	19.5971	18.9758	18.4823 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9955	0.9892	0.9737	0.9299	0.8256	0.6349	0.4434	0.4924	0.7626	0.9491	0.9902	0.9967 (94)
Ext temp.	593.4809	705.4788	788.9293	831.2415	778.3476	584.3154	390.7715	409.3980	592.6866	649.8979	589.4378	557.3462 (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	1630.6959	1586.2059	1441.0496	1203.8313	925.7528	613.2235	394.5938	415.7719	664.4867	1011.5089	1341.4488	1621.2054 (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	771.6880	591.8486	485.1775	268.2646	109.6694	0.0000	0.0000	0.0000	0.0000	269.0386	541.4479	791.5112 (98)
Space heating per m2										(98) / (4) =		3828.6458 (98)
												39.4380 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4099.1925 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	771.6880	591.8486	485.1775	268.2646	109.6694	0.0000	0.0000	0.0000	0.0000	269.0386	541.4479	791.5112	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	826.2184	633.6709	519.4620	287.2212	117.4191	0.0000	0.0000	0.0000	0.0000	288.0499	579.7087	847.4424	(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	211.7718	186.6754	196.0950	174.1764	168.6335	148.5230	142.2963	158.6270	160.3789	182.3415	192.7294	206.6976	(64)
Efficiency of water heater (217)m	88.0161	87.7534	87.2415	86.1350	83.9982	80.3000	80.3000	80.3000	80.3000	86.0289	87.5106	80.3000	(216)
Fuel for water heating, kWh/month	240.6056	212.7272	224.7725	202.2133	200.7584	184.9601	177.2059	197.5430	199.7247	211.9538	220.2356	234.6028	(219)
Water heating fuel used												2507.3029	(219)
Annual totals kWh/year													
Space heating fuel - main system												4099.1925	(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)												400.1551	(232)
Total delivered energy for all uses												7081.6506	(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	4099.1925	0.2160	885.4256 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2507.3029	0.2160	541.5774 (264)
Space and water heating			1427.0030 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	400.1551	0.5190	207.6805 (268)
Total CO2, kg/m2/year			1673.6085 (272)
Emissions per m2 for space and water heating			14.6992 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1393 (272b)
Emissions per m2 for pumps and fans			0.4010 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6992 * 1.00) + 2.1393 + 0.4010, rounded to 2 d.p.			17.2400 (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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1205 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3705 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3427 (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	0.4370	0.4284	0.4199	0.3770	0.3685	0.3256	0.3256	0.3170	0.3427	0.3685	0.3856	0.4027 (22b)
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (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)			13.1700	1.3258	17.4602		(27)
French Doors (Uw = 1.50)			5.6700	1.4151	8.0236		(27)
Ground Floor			49.2900	0.1200	5.9148	75.0000	3696.7500 (28a)
External Walls	104.0900	20.9400	83.1500	0.1900	15.7985	60.0000	4989.0000 (29a)
Pitched Cold Roof	47.7900		47.7900	0.1000	4.7790	9.0000	430.1100 (30)
Bay Roof	1.5000		1.5000	0.1000	0.1500	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			202.6700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	55.4861		(33)
Party Wall			48.2200	0.0000	0.0000	110.0000	5304.2000 (32)
Internal Wall - Masonry			54.3500			75.0000	4076.2500 (32c)
Internal Wall - Timber			68.2500			9.0000	614.2500 (32c)
Internal Floor			47.7900			18.0000	860.2200 (32d)
Internal Ceiling			47.7900			9.0000	430.1100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20414.3900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							210.2842 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1808 (36)
Total fabric heat loss						(33) + (36) =	69.6669 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.9081	48.6035	48.3050	46.9030	46.6407	45.4195	45.4195	45.1934	45.8899	46.6407	47.1713	47.7261 (38)
Heat transfer coeff	118.5750	118.2704	117.9719	116.5699	116.3076	115.0864	115.0864	114.8603	115.5568	116.3076	116.8382	117.3930 (39)
Average = Sum(39)m / 12 =												116.5686 (39)
HLP	1.2214	1.2183	1.2152	1.2008	1.1981	1.1855	1.1855	1.1832	1.1903	1.1981	1.2035	1.2092 (40)
HLP (average)												1.2007 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Energy content (annual)										Total =	Sum (45)m =	1551.0710 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.1727	29.8877	30.8414	26.8883	25.8000	22.2634	20.6303	23.6736	23.9563	27.9188	30.4755	33.0945 (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	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.6584	20.1250	16.3668	12.3907	9.2622	7.8195	8.4493	10.9827	14.7409	18.7170	21.8455	23.2882 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.5189	254.1289	247.5518	233.5500	215.8753	199.2635	188.1658	185.5559	192.1329	206.1347	223.8095	240.4212 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540 (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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320 (71)
Water heating gains (Table 5)	45.9311	44.4757	41.4535	37.3449	34.6774	30.9214	27.7289	31.8193	33.2727	37.5253	42.3271	44.4818 (72)
Total internal gains	383.7704	382.3916	369.0341	346.9476	323.4769	301.6665	288.0060	292.0199	303.8086	326.0390	351.6441	371.8532 (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	6.3900	10.6334	0.6300	0.7000	0.7700	20.7656 (74)
East	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070 (76)
South	2.8800	46.7521	0.6300	0.7000	0.7700	41.1496 (78)
West	0.9000	19.6403	0.6300	0.7000	0.7700	5.4021 (80)
South	5.6700	46.7521	0.6300	0.7000	0.7700	81.0132 (78)

Solar gains	166.3374	285.5483	397.7027	506.3441	580.8611	583.0470	559.4357	502.6320	435.0129	317.3715	199.6099	142.1215 (83)
Total gains	550.1078	667.9399	766.7369	853.2916	904.3380	884.7135	847.4418	794.6519	738.8215	643.4105	551.2540	513.9748 (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	47.8234	47.9466	48.0679	48.6460	48.7558	49.2731	49.2731	49.3701	49.0725	48.7558	48.5343	48.3049
alpha	4.1882	4.1964	4.2045	4.2431	4.2504	4.2849	4.2849	4.2913	4.2715	4.2504	4.2356	4.2203
util living area	0.9966	0.9920	0.9808	0.9496	0.8743	0.7301	0.5692	0.6212	0.8398	0.9668	0.9932	0.9975 (86)
MIT	19.4390	19.6456	19.9537	20.3429	20.6813	20.9004	20.9736	20.9618	20.8060	20.3564	19.8221	19.4049 (87)
Th 2	19.9029	19.9054	19.9079	19.9194	19.9216	19.9316	19.9316	19.9335	19.9277	19.9216	19.9172	19.9126 (88)
util rest of house	0.9956	0.9896	0.9749	0.9330	0.8314	0.6418	0.4440	0.4963	0.7710	0.9527	0.9908	0.9967 (89)
MIT 2	18.4831	18.6905	18.9972	19.3847	19.6977	19.8813	19.9238	19.9209	19.8138	19.4054	18.8762	18.4566 (90)
Living area fraction	0.9956	0.9896	0.9749	0.9330	0.8314	0.6418	0.4440	0.4963	0.7710	0.9527	0.9908	0.9967 (89)
MIT	18.6583	18.8656	19.1725	19.5603	19.8779	20.0681	20.1162	20.1117	19.9957	19.5797	19.0496	18.6304 (92)
Temperature adjustment	18.6583	18.8656	19.1725	19.5603	19.8779	20.0681	20.1162	20.1117	19.9957	19.5797	19.0496	18.6304 (93)
adjusted MIT	18.6583	18.8656	19.1725	19.5603	19.8779	20.0681	20.1162	20.1117	19.9957	19.5797	19.0496	18.6304 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9940	0.9865	0.9697	0.9261	0.8294	0.6542	0.4668	0.5186	0.7761	0.9468	0.9881	0.9955 (94)
Ext temp.	546.8173	658.9528	743.4743	790.2594	750.0515	578.7389	395.5769	412.1453	573.3865	609.2039	544.6903	511.6373 (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	1702.5305	1651.7133	1494.9996	1242.6645	951.1575	629.2998	404.6654	426.3250	681.2832	1044.4051	1396.1666	1694.0287 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating	859.8506	667.1350	559.1349	325.7317	149.6229	0.0000	0.0000	0.0000	0.0000	323.7897	613.0629	879.6992 (98)
Space heating per m2												4378.0268 (98)
										(98) / (4) =		45.0971 (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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1081.8125	851.6396	872.9383	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8306	0.8962	0.8721	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	898.5218	763.2361	761.2685	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1137.5536	1091.7742	1031.9086	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	172.1029	244.4324	201.3562	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			617.8915	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	43.0257	61.1081	50.3391	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												154.4729	(107)
Energy for space heating												1.5912	(108)
Energy for space cooling												45.0971	(99)
Total												1.5912	(108)
Dwelling Fabric Energy Efficiency (DFEE)												46.6883	(109)
												46.7	(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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1205 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3705 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3427 (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	0.4370	0.4284	0.4199	0.3770	0.3685	0.3256	0.3256	0.3170	0.3427	0.3685	0.3856	0.4027 (22b)
Effective ac	0.5955	0.5918	0.5881	0.5711	0.5679	0.5530	0.5530	0.5503	0.5587	0.5679	0.5743	0.5811 (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)			18.8400	1.3258	24.9773		(27)
Ground Floor			49.2900	0.1300	6.4077		(28a)
External Walls	104.0900	20.9400	83.1500	0.1800	14.9670		(29a)
Pitched Cold Roof	47.7900		47.7900	0.1300	6.2127		(30)
Bay Roof	1.5000		1.5000	0.1300	0.1950		(30)
Total net area of external elements Aum(A, m ²)			202.6700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	54.8597	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.9259 (36)
Total fabric heat loss						(33) + (36) =	65.7856 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	48.9081	48.6035	48.3050	46.9030	46.6407	45.4195	45.4195	45.1934	45.8899	46.6407	47.1713	47.7261 (38)
Heat transfer coeff	114.6936	114.3891	114.0906	112.6886	112.4262	111.2051	111.2051	110.9790	111.6755	112.4262	112.9569	113.5117 (39)
Average = Sum(39)m / 12 =												112.6873 (39)
HLP	1.1814	1.1783	1.1752	1.1608	1.1581	1.1455	1.1455	1.1432	1.1503	1.1581	1.1635	1.1693 (40)
HLP (average)												1.1608 (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												2.7108 (42)
Average daily hot water use (litres/day)												98.5815 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397 (44)
Energy content (annual)	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1551.0710 (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	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.1727	29.8877	30.8414	26.8883	25.8000	22.2634	20.6303	23.6736	23.9563	27.9188	30.4755	33.0945 (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	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	135.5400	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.6584	20.1250	16.3668	12.3907	9.2622	7.8195	8.4493	10.9827	14.7409	18.7170	21.8455	23.2882	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	251.5189	254.1289	247.5518	233.5500	215.8753	199.2635	188.1658	185.5559	192.1329	206.1347	223.8095	240.4212	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	36.5540	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	45.9311	44.4757	41.4535	37.3449	34.6774	30.9214	27.7289	31.8193	33.2727	37.5253	42.3271	44.4818	(72)
Total internal gains	383.7704	382.3916	369.0341	346.9476	323.4769	301.6665	288.0060	292.0199	303.8086	326.0390	351.6441	371.8532	(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	6.3900	10.6334	0.6300	0.7000	0.7700	20.7656	(74)
East	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(76)
South	8.5500	46.7521	0.6300	0.7000	0.7700	122.1627	(78)
West	0.9000	19.6403	0.6300	0.7000	0.7700	5.4021	(80)

Solar gains	166.3374	285.5483	397.7027	506.3441	580.8611	583.0470	559.4357	502.6320	435.0129	317.3715	199.6099	142.1215	(83)
Total gains	550.1078	667.9399	766.7369	853.2916	904.3380	884.7135	847.4418	794.6519	738.8215	643.4105	551.2540	513.9748	(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	58.7798	58.9363	59.0905	59.8257	59.9652	60.6237	60.6237	60.7472	60.3684	59.9652	59.6835	59.3918	
alpha	4.9187	4.9291	4.9394	4.9884	4.9977	5.0416	5.0416	5.0498	5.0246	4.9977	4.9789	4.9595	
util living area	0.9985	0.9957	0.9879	0.9616	0.8875	0.7326	0.5615	0.6160	0.8510	0.9766	0.9965	0.9989	(86)
MIT	19.6859	19.8676	20.1363	20.4757	20.7653	20.9385	20.9870	20.9797	20.8628	20.4775	20.0149	19.6565	(87)
Th 2	19.9349	19.9374	19.9399	19.9515	19.9537	19.9638	19.9638	19.9657	19.9599	19.9537	19.9493	19.9447	(88)
util rest of house	0.9979	0.9942	0.9834	0.9467	0.8438	0.6410	0.4374	0.4905	0.7797	0.9648	0.9950	0.9985	(89)
MIT 2	18.7380	18.9210	19.1894	19.5290	19.7945	19.9354	19.9605	19.9600	19.8841	19.5375	19.0779	18.7165	(90)
Living area fraction									fLA = Living area / (4) =			0.1833	(91)
MIT	18.9117	19.0945	19.3629	19.7025	19.9724	20.1192	20.1486	20.1468	20.0635	19.7098	19.2496	18.8888	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9117	19.0945	19.3629	19.7025	19.9724	20.1192	20.1486	20.1468	20.0635	19.7098	19.2496	18.8888	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9972	0.9926	0.9802	0.9423	0.8447	0.6560	0.4603	0.5136	0.7879	0.9612	0.9936	0.9980	(94)
Ext temp.	548.5639	662.9814	751.5901	804.0691	763.9112	580.3488	390.1095	408.1356	582.1405	618.4423	547.7231	512.9359	(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	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	838.7178	645.5981	532.6648	297.5404	123.5921	0.0000	0.0000	0.0000	0.0000	301.8675	593.7560	858.8824	(98)
Space heating per m2										(98) / (4) =		43.1873	(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	1045.3279	822.9177	843.4401	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8677	0.9277	0.9064	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	906.9846	763.4069	764.5020	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1137.5536	1091.7742	1031.9086	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

	0.0000	0.0000	0.0000	0.0000	0.0000	166.0097	244.3053	198.9506	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												609.2655 (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	41.5024	61.0763	49.7376	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												152.3164 (107)
Space cooling per m2												1.5690 (108)
Energy for space heating												43.1873 (99)
Energy for space cooling												1.5690 (108)
Total												44.7562 (109)
Target Fabric Energy Efficiency (TFEE)												51.5 (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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2313 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.2659	0.2428	0.2370	0.2313	0.2428	0.2139	0.2255	0.2139	0.2139	0.2313	0.2255	0.2370 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5159	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			13.1700	1.3258	17.4602		(27)					
French Doors (Uw = 1.50)			5.6700	1.4151	8.0236		(27)					
Ground Floor			49.2900	0.1200	5.9148	75.0000	3696.7500 (28a)					
External Walls	104.0900	20.9400	83.1500	0.1900	15.7985	60.0000	4989.0000 (29a)					
Pitched Cold Roof	47.7900		47.7900	0.1000	4.7790	9.0000	430.1100 (30)					
Bay Roof	1.5000		1.5000	0.1000	0.1500	9.0000	13.5000 (30)					
Total net area of external elements Aum(A, m2)			202.6700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4861			(33)					
Party Wall			48.2200	0.0000	0.0000	110.0000	5304.2000 (32)					
Internal Wall - Masonry			54.3500			75.0000	4076.2500 (32c)					
Internal Wall - Timber			68.2500			9.0000	614.2500 (32c)					
Internal Floor			47.7900			18.0000	860.2200 (32d)					
Internal Ceiling			47.7900			18.0000	860.2200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	20844.5000	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							214.7147 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1808 (36)					
Total fabric heat loss						(33) + (36) =	69.6669 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.3746	Feb 41.0656	Mar 41.0656	Apr 41.0656	May 41.0656	Jun 41.0656	Jul 41.0656	Aug 41.0656	Sep 41.0656	Oct 41.0656	Nov 41.0656	Dec 41.0656 (38)
Heat transfer coeff	112.0415	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326 (39)
Average = Sum(39)m / 12 =												110.8416 (39)
HLP	Jan 1.1541	Feb 1.1406	Mar 1.1406	Apr 1.1406	May 1.1406	Jun 1.1406	Jul 1.1406	Aug 1.1406	Sep 1.1406	Oct 1.1406	Nov 1.1406	Dec 1.1406 (40)
HLP (average)												1.1418 (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	2.7108 (42)
Average daily hot water use (litres/day)	98.5815 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397	(44)
Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387	(45)
Energy content (annual)										Total =	Sum(45)m =	1551.0710	(45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	18.8122	16.9451	18.6538	17.8682	18.3243	17.5723	18.0579	18.2306	17.7335	18.5149	18.0820	18.7609	(61)
Total heat required for water heating calculated for each month	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(64)
RHI water heating demand										Total per year (kWh/year) =	Sum(64)m =	1768.6268	(64)
Heat gains from water heating, kWh/month	58.1733	51.0017	52.9212	46.5393	44.9504	39.2288	36.7949	41.5999	41.9180	48.3134	52.2058	56.4733	(65)
												1769	(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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.6461	50.3126	40.9169	30.9767	23.1555	19.5488	21.1232	27.4567	36.8524	46.7926	54.6138	58.2205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	78.1900	75.8954	71.1307	64.6379	60.4172	54.4844	49.4555	55.9138	58.2194	64.9374	72.5080	75.9050	(72)
Total internal gains	621.4290	616.6964	592.7195	555.3884	516.9662	482.6331	462.6148	471.5112	493.0290	530.5853	572.3574	604.1547	(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					6.3900	14.6401		0.6300	0.7000	0.7700		28.5901 (74)	
East					3.0000	27.3735		0.6300	0.7000	0.7700		25.0971 (76)	
South					2.8800	61.3950		0.6300	0.7000	0.7700		54.0377 (78)	
West					0.9000	27.3735		0.6300	0.7000	0.7700		7.5291 (80)	
South					5.6700	61.3950		0.6300	0.7000	0.7700		106.3868 (78)	

Solar gains	221.6408	312.8001	435.9162	572.2033	637.7440	686.6868	657.8700	589.2837	508.6164	371.2684	254.9877	183.7266	(83)
Total gains	843.0698	929.4965	1028.6357	1127.5918	1154.7103	1169.3199	1120.4848	1060.7949	1001.6454	901.8537	827.3451	787.8814	(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	51.6785	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894		
alpha	4.4452	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860		
util living area	0.9798	0.9683	0.9346	0.8511	0.6962	0.4818	0.3247	0.3324	0.5982	0.8561	0.9586	0.9833	(86)	
MIT	19.9849	20.1335	20.4058	20.7061	20.9106	20.9864	20.9982	20.9981	20.9651	20.7550	20.3431	19.9727	(87)	
Th 2	19.9569	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	(88)	
util rest of house	0.9742	0.9597	0.9170	0.8130	0.6274	0.3910	0.2239	0.2261	0.5028	0.8086	0.9452	0.9785	(89)	
MIT 2	19.0638	19.2173	19.4785	19.7517	19.9164	19.9631	19.9675	19.9675	19.9534	19.8008	19.4234	19.0610	(90)	
Living area fraction									fLA = Living area / (4) =			0.1833	(91)	
MIT	19.2326	19.3852	19.6485	19.9266	20.0986	20.1506	20.1564	20.1564	20.1388	19.9757	19.5920	19.2281	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.2326	19.3852	19.6485	19.9266	20.0986	20.1506	20.1564	20.1564	20.1388	19.9757	19.5920	19.2281	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9692	0.9537	0.9105	0.8113	0.6367	0.4074	0.2424	0.2456	0.5194	0.8091	0.9391	0.9740	(94)
Useful gains	817.0873	886.4369	936.5597	914.8497	735.1725	476.4063	271.6445	260.5641	520.2530	729.6484	776.9711	767.4261	(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	1561.0286	1515.3983	1356.3035	1110.2698	786.0435	481.7517	272.0042	260.9286	535.8108	883.1691	1239.3154	1520.1483	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	553.4923	422.6620	312.2893	140.7025	37.8481	0.0000	0.0000	0.0000	0.0000	114.2193	332.8878	560.0253 (98)
Space heating												2474.1267 (98)
RHI space heating demand												2474 (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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5448	0.5391	0.5333	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5102	0.5217 (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)			13.1700	1.3258	17.4602		(27)					
French Doors (Uw = 1.50)			5.6700	1.4151	8.0236		(27)					
Ground Floor			49.2900	0.1200	5.9148	75.0000	3696.7500 (28a)					
External Walls	104.0900	20.9400	83.1500	0.1900	15.7985	60.0000	4989.0000 (29a)					
Pitched Cold Roof	47.7900		47.7900	0.1000	4.7790	9.0000	430.1100 (30)					
Bay Roof	1.5000		1.5000	0.1000	0.1500	9.0000	13.5000 (30)					
Total net area of external elements Aum(A, m2)			202.6700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4861			(33)					
Party Wall			48.2200	0.0000	0.0000	110.0000	5304.2000 (32)					
Internal Wall - Masonry			54.3500			75.0000	4076.2500 (32c)					
Internal Wall - Timber			68.2500			9.0000	614.2500 (32c)					
Internal Floor			47.7900			18.0000	860.2200 (32d)					
Internal Ceiling			47.7900			18.0000	860.2200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	20844.5000	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							214.7147 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1808 (36)					
Total fabric heat loss						(33) + (36) =	69.6669 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.7487	Feb 44.2739	Mar 43.7991	Apr 41.4250	May 41.0656	Jun 41.0656	Jul 41.0656	Aug 41.0656	Sep 41.0656	Oct 41.0656	Nov 41.8998	Dec 42.8494 (38)
Heat transfer coeff	114.4156	113.9408	113.4660	111.0919	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	111.5667	112.5163 (39)
Average = Sum(39)m / 12 =												111.7827 (39)
HLP	Jan 1.1786	Feb 1.1737	Mar 1.1688	Apr 1.1443	May 1.1406	Jun 1.1406	Jul 1.1406	Aug 1.1406	Sep 1.1406	Oct 1.1406	Nov 1.1492	Dec 1.1590 (40)
HLP (average)												1.1514 (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	2.7108 (42)
Average daily hot water use (litres/day)	98.5815 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397	(44)
Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387	(45)
Energy content (annual)	Total = Sum (45)m = 1551.0710												(45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	18.8122	16.9451	18.6538	17.8682	18.3243	17.5723	18.0579	18.2306	17.7335	18.5149	18.0820	18.7609	(61)
Total heat required for water heating calculated for each month	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(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	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(64)
Heat gains from water heating, kWh/month	58.1733	51.0017	52.9212	46.5393	44.9504	39.2288	36.7949	41.5999	41.9180	48.3134	52.2058	56.4733	(65)
Total per year (kWh/year) = Sum (64)m =	1768.6268												(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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.6461	50.3126	40.9169	30.9767	23.1555	19.5488	21.1232	27.4567	36.8524	46.7926	54.6138	58.2205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	78.1900	75.8954	71.1307	64.6379	60.4172	54.4844	49.4555	55.9138	58.2194	64.9374	72.5080	75.9050	(72)
Total internal gains	621.4290	616.6964	592.7195	555.3884	516.9662	482.6331	462.6148	471.5112	493.0290	530.5853	572.3574	604.1547	(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				6.3900	10.6334		0.6300		0.7000		0.7700		20.7656 (74)
East				3.0000	19.6403		0.6300		0.7000		0.7700		18.0070 (76)
South				2.8800	46.7521		0.6300		0.7000		0.7700		41.1496 (78)
West				0.9000	19.6403		0.6300		0.7000		0.7700		5.4021 (80)
South				5.6700	46.7521		0.6300		0.7000		0.7700		81.0132 (78)
Solar gains	166.3374	285.5483	397.7027	506.3441	580.8611	583.0470	559.4357	502.6320	435.0129	317.3715	199.6099	142.1215	(83)
Total gains	787.7664	902.2447	990.4223	1061.7325	1097.8274	1065.6801	1022.0505	974.1432	928.0419	847.9568	771.9673	746.2763	(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	50.6062	50.8171	51.0297	52.1203	52.2894	52.2894	52.2894	52.2894	52.2894	51.8984	51.4604		
alpha	4.3737	4.3878	4.4020	4.4747	4.4860	4.4860	4.4860	4.4860	4.4860	4.4599	4.4307		
util living area	0.9877	0.9769	0.9544	0.8992	0.7906	0.6250	0.4676	0.5089	0.7306	0.9179	0.9771	0.9901	(86)
MIT	19.7738	19.9673	20.2407	20.5753	20.8234	20.9535	20.9898	20.9851	20.9061	20.5927	20.1326	19.7485	(87)
Th 2	19.9372	19.9411	19.9451	19.9648	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9608	19.9529	(88)
util rest of house	0.9843	0.9707	0.9420	0.8717	0.7367	0.5390	0.3624	0.4013	0.6507	0.8895	0.9699	0.9873	(89)
MIT 2	18.8398	19.0330	19.3023	19.6337	19.8513	19.9460	19.9650	19.9633	19.9178	19.6590	19.2136	18.8273	(90)
Living area fraction	19.0109	19.2042	19.4742	19.8063	20.0295	20.1306	20.1528	20.1505	20.0989	19.8301	19.3820	18.9961	(91)
MIT	19.0109	19.2042	19.4742	19.8063	20.0295	20.1306	20.1528	20.1505	20.0989	19.8301	19.3820	18.9961	(92)
Temperature adjustment													0.0000
adjusted MIT	19.0109	19.2042	19.4742	19.8063	20.0295	20.1306	20.1528	20.1505	20.0989	19.8301	19.3820	18.9961	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9804	0.9652	0.9352	0.8669	0.7402	0.5533	0.3816	0.4209	0.6618	0.8850	0.9647	0.9840	(94)
Useful gains	772.3655	870.8739	926.2624	920.3948	812.6636	589.6244	390.0496	410.0566	614.1393	750.4588	744.7002	734.3559	(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	1683.1606	1629.8366	1472.1344	1211.5999	922.3449	612.4205	393.4075	415.3065	664.2708	1022.0735	1370.2611	1664.8064	(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	677.6316	510.0229	406.1287	209.6677	81.6029	0.0000	0.0000	0.0000	0.0000	202.0814	450.4039	692.2552	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 3229.7942 (98)
Space heating per m2 (98) / (4) = 33.2694 (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 %) 90.0000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 3588.6602 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	677.6316	510.0229	406.1287	209.6677	81.6029	0.0000	0.0000	0.0000	0.0000	202.0814	450.4039	692.2552 (98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000 (210)
Space heating fuel (main heating system)	752.9239	566.6922	451.2542	232.9641	90.6698	0.0000	0.0000	0.0000	0.0000	224.5348	500.4488	769.1724 (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	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996 (64)
Efficiency of water heater (217)m	89.3544	89.2733	89.1168	88.7519	88.0825	87.0000	87.0000	87.0000	87.0000	88.6975	89.1883	87.0000 (216)
Fuel for water heating, kWh/month	201.0254	176.5288	183.7923	162.7023	158.6421	140.6222	132.3469	149.0066	149.9646	168.9986	181.0734	195.2345 (219)
Water heating fuel used												1999.9378 (219)
Annual totals kWh/year												
Space heating fuel - main system												3588.6602 (211)
Space heating fuel - secondary												0.0000 (215)

Electricity for pumps and fans:
(MEV)Decentralised, Database: total watage = 10.0340, total flow = 37.0000, SFP = 0.2712)
mechanical ventilation fans (SFP = 0.2712) 82.3430 (230a)
central heating pump 30.0000 (230c)
main heating flue fan 45.0000 (230e)
Total electricity for the above, kWh/year 157.3430 (231)
Electricity for lighting (calculated in Appendix L) 400.1551 (232)

Energy saving/generation technologies (Appendices M ,N and Q)
PV Unit 0 (0.80 * 0.76 * 1068 * 1.00) = -649.3869 -649.3869 (233)
Total delivered energy for all uses 5496.7093 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3588.6602	3.4800	124.8854 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1999.9378	3.4800	69.5978 (247)
Mechanical ventilation fans	82.3430	13.1900	10.8610 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	400.1551	13.1900	52.7805 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-649.3869	13.1900	-85.6541 (252)
Total energy cost			302.3631 (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] = 0.8938 (257)
SAP value 87.5314
SAP rating (Section 12) 88 (258)
SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3588.6602	0.2160	775.1506 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1999.9378	0.2160	431.9866 (264)
Space and water heating			1207.1372 (265)
Pumps and fans	157.3430	0.5190	81.6610 (267)
Energy for lighting	400.1551	0.5190	207.6805 (268)
Energy saving/generation technologies			
PV Unit	-649.3869	0.5190	-337.0318 (269)
Total kg/year			1159.4469 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

CO2 emissions per m2	11.9400 (273)
EI value	89.0649
EI rating	89 (274)
EI band	B

Calculation of stars for heating and DHW	

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8832 = 3.940$, stars = 4
Water heating environmental impact	$0.216 / 0.8832 = 0.2446$, 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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2313 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.2659	0.2428	0.2370	0.2313	0.2428	0.2139	0.2255	0.2139	0.2139	0.2313	0.2255	0.2370 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5159	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			13.1700	1.3258	17.4602		(27)					
French Doors (Uw = 1.50)			5.6700	1.4151	8.0236		(27)					
Ground Floor			49.2900	0.1200	5.9148	75.0000	3696.7500 (28a)					
External Walls	104.0900	20.9400	83.1500	0.1900	15.7985	60.0000	4989.0000 (29a)					
Pitched Cold Roof	47.7900		47.7900	0.1000	4.7790	9.0000	430.1100 (30)					
Bay Roof	1.5000		1.5000	0.1000	0.1500	9.0000	13.5000 (30)					
Total net area of external elements Aum(A, m2)			202.6700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4861			(33)					
Party Wall			48.2200	0.0000	0.0000	110.0000	5304.2000 (32)					
Internal Wall - Masonry			54.3500			75.0000	4076.2500 (32c)					
Internal Wall - Timber			68.2500			9.0000	614.2500 (32c)					
Internal Floor			47.7900			18.0000	860.2200 (32d)					
Internal Ceiling			47.7900			18.0000	860.2200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	20844.5000	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							214.7147 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1808 (36)					
Total fabric heat loss						(33) + (36) =	69.6669 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.3746	Feb 41.0656	Mar 41.0656	Apr 41.0656	May 41.0656	Jun 41.0656	Jul 41.0656	Aug 41.0656	Sep 41.0656	Oct 41.0656	Nov 41.0656	Dec 41.0656 (38)
Heat transfer coeff	112.0415	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326 (39)
Average = Sum(39)m / 12 =												110.8416 (39)
HLP	Jan 1.1541	Feb 1.1406	Mar 1.1406	Apr 1.1406	May 1.1406	Jun 1.1406	Jul 1.1406	Aug 1.1406	Sep 1.1406	Oct 1.1406	Nov 1.1406	Dec 1.1406 (40)
HLP (average)												1.1418 (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	2.7108 (42)
Average daily hot water use (litres/day)	98.5815 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397	(44)
Energy conte	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387	(45)
Energy content (annual)	Total = Sum (45)m = 1551.0710												(45)
Distribution loss (46)m = 0.15 x (45)m	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	18.8122	16.9451	18.6538	17.8682	18.3243	17.5723	18.0579	18.2306	17.7335	18.5149	18.0820	18.7609	(61)
Total heat required for water heating calculated for each month	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(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	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(64)
Heat gains from water heating, kWh/month	58.1733	51.0017	52.9212	46.5393	44.9504	39.2288	36.7949	41.5999	41.9180	48.3134	52.2058	56.4733	(65)
Total per year (kWh/year) = Sum (64)m =	1768.6268												(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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.6461	50.3126	40.9169	30.9767	23.1555	19.5488	21.1232	27.4567	36.8524	46.7926	54.6138	58.2205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	78.1900	75.8954	71.1307	64.6379	60.4172	54.4844	49.4555	55.9138	58.2194	64.9374	72.5080	75.9050	(72)
Total internal gains	621.4290	616.6964	592.7195	555.3884	516.9662	482.6331	462.6148	471.5112	493.0290	530.5853	572.3574	604.1547	(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					6.3900	14.6401		0.6300	0.7000	0.7700		28.5901 (74)	
East					3.0000	27.3735		0.6300	0.7000	0.7700		25.0971 (76)	
South					2.8800	61.3950		0.6300	0.7000	0.7700		54.0377 (78)	
West					0.9000	27.3735		0.6300	0.7000	0.7700		7.5291 (80)	
South					5.6700	61.3950		0.6300	0.7000	0.7700		106.3868 (78)	

Solar gains	221.6408	312.8001	435.9162	572.2033	637.7440	686.6868	657.8700	589.2837	508.6164	371.2684	254.9877	183.7266	(83)
Total gains	843.0698	929.4965	1028.6357	1127.5918	1154.7103	1169.3199	1120.4848	1060.7949	1001.6454	901.8537	827.3451	787.8814	(84)

7. Mean internal temperature (heating season)

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	51.6785	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	
alpha	4.4452	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	
util living area	0.9798	0.9683	0.9346	0.8511	0.6962	0.4818	0.3247	0.3324	0.5982	0.8561	0.9586	0.9833	(86)
MIT	19.9849	20.1335	20.4058	20.7061	20.9106	20.9864	20.9982	20.9981	20.9651	20.7550	20.3431	19.9727	(87)
Th 2	19.9569	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	(88)
util rest of house	0.9742	0.9597	0.9170	0.8130	0.6274	0.3931	0.2239	0.2261	0.5028	0.8086	0.9452	0.9785	(89)
MIT 2	19.0638	19.2173	19.4785	19.7517	19.9164	19.9610	19.9675	19.9675	19.9534	19.8008	19.4234	19.0610	(90)
Living area fraction	19.2326	19.3852	19.6485	19.9266	20.0986	20.1506	20.1564	20.1564	20.1388	19.9757	19.5920	19.2281	(91)
MIT	19.2326	19.3852	19.6485	19.9266	20.0986	20.1506	20.1564	20.1564	20.1388	19.9757	19.5920	19.2281	(92)
Temperature adjustment	19.2326	19.3852	19.6485	19.9266	20.0986	20.1506	20.1564	20.1564	20.1388	19.9757	19.5920	19.2281	(93)
adjusted MIT	19.2326	19.3852	19.6485	19.9266	20.0986	20.1506	20.1564	20.1564	20.1388	19.9757	19.5920	19.2281	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	817.0873	886.4369	936.5597	914.8497	735.1725	476.4063	271.6445	260.5641	520.2530	729.6484	776.9711	767.4261	(94)
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	1561.0286	1515.3983	1356.3035	1110.2698	786.0435	481.7517	272.0042	260.9286	535.8108	883.1691	1239.3154	1520.1483	(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	553.4923	422.6620	312.2893	140.7025	37.8481	0.0000	0.0000	0.0000	0.0000	114.2193	332.8878	560.0253	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating
Space heating per m2 (98) / (4) = 2474.1267 (98)
25.4854 (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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2749.0297 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	553.4923	422.6620	312.2893	140.7025	37.8481	0.0000	0.0000	0.0000	0.0000	114.2193	332.8878	560.0253	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	614.9914	469.6245	346.9882	156.3361	42.0534	0.0000	0.0000	0.0000	0.0000	126.9104	369.8754	622.2503	(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	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(64)
Efficiency of water heater (217)m	89.2460	89.1649	88.9448	88.4551	87.6225	87.0000	87.0000	87.0000	87.0000	88.2725	88.9975	89.2687	(216)
Fuel for water heating, kWh/month	201.2696	176.7434	184.1478	163.2481	159.4749	140.6222	132.3469	149.0066	149.9646	169.8123	181.4616	195.4768	(219)
Water heating fuel used												2003.5748	(219)
Annual totals kWh/year													
Space heating fuel - main system												2749.0297	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 10.0340, total flow = 37.0000, SFP = 0.2712)													
mechanical ventilation fans (SFP = 0.2712)												82.3430	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												157.3430	(231)
Electricity for lighting (calculated in Appendix L)												400.1551	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.76 * 1246 * 1.00) =										-757.5778		-757.5778	(233)
Total delivered energy for all uses												4552.5249	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2749.0297	3.6300	99.7898 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2003.5748	3.6300	72.7298 (247)
Mechanical ventilation fans	82.3430	19.4400	16.0075 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	400.1551	19.4400	77.7902 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-757.5778	19.4400	-147.2731 (252)
Total energy cost			228.6241 (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	2749.0297	0.2160	593.7904 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2003.5748	0.2160	432.7722 (264)
Space and water heating			1026.5626 (265)
Pumps and fans	157.3430	0.5190	81.6610 (267)
Energy for lighting	400.1551	0.5190	207.6805 (268)
Energy saving/generation technologies			
PV Unit	-757.5778	0.5190	-393.1829 (269)
Total kg/year			922.7213 (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	2749.0297	1.2200	3353.8162 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2003.5748	1.2200	2444.3613 (264)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space and water heating			5798.1775 (265)
Pumps and fans	157.3430	3.0700	483.0431 (267)
Energy for lighting	400.1551	3.0700	1228.4762 (268)
Energy saving/generation technologies			
PV Unit	-757.5778	3.0700	-2325.7638 (269)
Primary energy kWh/year			5183.9331 (272)
Primary energy kWh/m2/year			53.3986 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 28	-198 kg (21.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£28 2.04 kg/m²	B 89	B 91
Total Savings	£28 2.04 kg/m²		

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

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	£108	£118	-£10
Mains gas	£268	£230	£38
Space heating	£225	£225	£0
Water heating	£73	£45	£28
Lighting	£78	£78	£0
Generated (PV)	-£147	-£147	£0
Total cost of fuels	£229	£201	£28
Total cost of uses	£229	£201	£28
Delivered energy	47 kWh/m²	37 kWh/m²	10 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	53 kWh/m²	42 kWh/m²	11 kWh/m²

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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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											1 (19)		
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2313 (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	0.2948	0.2891	0.2833	0.2544	0.2486	0.2197	0.2197	0.2139	0.2313	0.2486	0.2602	0.2717 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:												0.5000 (23a)	
Effective ac	0.5448	0.5391	0.5333	0.5044	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5102	0.5217 (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)			13.1700	1.3258	17.4602		(27)					
French Doors (Uw = 1.50)			5.6700	1.4151	8.0236		(27)					
Ground Floor			49.2900	0.1200	5.9148	75.0000	3696.7500 (28a)					
External Walls	104.0900	20.9400	83.1500	0.1900	15.7985	60.0000	4989.0000 (29a)					
Pitched Cold Roof	47.7900		47.7900	0.1000	4.7790	9.0000	430.1100 (30)					
Bay Roof	1.5000		1.5000	0.1000	0.1500	9.0000	13.5000 (30)					
Total net area of external elements Aum(A, m2)			202.6700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4861			(33)					
Party Wall			48.2200	0.0000	0.0000	110.0000	5304.2000 (32)					
Internal Wall - Masonry			54.3500			75.0000	4076.2500 (32c)					
Internal Wall - Timber			68.2500			9.0000	614.2500 (32c)					
Internal Floor			47.7900			18.0000	860.2200 (32d)					
Internal Ceiling			47.7900			18.0000	860.2200 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =	20844.5000	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							214.7147 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1808 (36)					
Total fabric heat loss						(33) + (36) =	69.6669 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 44.7487	Feb 44.2739	Mar 43.7991	Apr 41.4250	May 41.0656	Jun 41.0656	Jul 41.0656	Aug 41.0656	Sep 41.0656	Oct 41.0656	Nov 41.8998	Dec 42.8494 (38)
Heat transfer coeff	114.4156	113.9408	113.4660	111.0919	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	111.5667	112.5163 (39)
Average = Sum(39)m / 12 =												111.7827 (39)
HLP	Jan 1.1786	Feb 1.1737	Mar 1.1688	Apr 1.1443	May 1.1406	Jun 1.1406	Jul 1.1406	Aug 1.1406	Sep 1.1406	Oct 1.1406	Nov 1.1492	Dec 1.1590 (40)
HLP (average)												1.1514 (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	2.7108 (42)
Average daily hot water use (litres/day)	98.5815 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397	(44)
Energy content (annual)	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1551.0710	(45)
Water storage loss:	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	18.8122	16.9451	18.6538	17.8682	18.3243	17.5723	18.0579	18.2306	17.7335	18.5149	18.0820	18.7609	(61)
Total heat required for water heating calculated for each month	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(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													1.1693 (H8)
Utilisation factor													0.5748 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													98.5815 (H14)
Volume ratio Veff/V													0.7608 (H15)
Solar storage volume factor													0.9453 (H16)
Solar input	-25.1278	-41.9311	-71.4135	-95.7082	-118.2395	-116.2482	-114.7119	-100.2244	-78.4958	-53.6034	-29.8052	-866.5370	(H17)
Solar input (sum of months) = Sum (63)m =													-21.0277 (63)
Output from w/h	154.4972	115.6620	92.3764	48.6931	21.4964	6.0931	0.4298	29.4114	51.9734	96.2941	131.6911	153.4719	(64)
Total per year (kWh/year) = Sum (64)m =													902.0898 (64)
Heat gains from water heating, kWh/month	58.1733	51.0017	52.9212	46.5393	44.9504	39.2288	36.7949	41.5999	41.9180	48.3134	52.2058	56.4733	(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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.6461	50.3126	40.9169	30.9767	23.1555	19.5488	21.1232	27.4567	36.8524	46.7926	54.6138	58.2205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	78.1900	75.8954	71.1307	64.6379	60.4172	54.4844	49.4555	55.9138	58.2194	64.9374	72.5080	75.9050	(72)
Total internal gains	621.4290	616.6964	592.7195	555.3884	516.9662	482.6331	462.6148	471.5112	493.0290	530.5853	572.3574	604.1547	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g or Table 6c	FF or Table 6c	Access factor Table 6d	Gains W	
North	6.3900	10.6334	0.6300	0.7000	0.7700		20.7656	(74)
East	3.0000	19.6403	0.6300	0.7000	0.7700		18.0070	(76)
South	2.8800	46.7521	0.6300	0.7000	0.7700		41.1496	(78)
West	0.9000	19.6403	0.6300	0.7000	0.7700		5.4021	(80)
South	5.6700	46.7521	0.6300	0.7000	0.7700		81.0132	(78)

Solar gains	166.3374	285.5483	397.7027	506.3441	580.8611	583.0470	559.4357	502.6320	435.0129	317.3715	199.6099	142.1215	(83)
Total gains	787.7664	902.2447	990.4223	1061.7325	1097.8274	1065.6801	1022.0505	974.1432	928.0419	847.9568	771.9673	746.2763	(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)													
tau	50.6062	50.8171	51.0297	52.1203	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	51.8984	51.4604	
alpha	4.3737	4.3878	4.4020	4.4747	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4599	4.4307	
util living area	0.9877	0.9769	0.9544	0.8992	0.7906	0.6250	0.4676	0.5089	0.7306	0.9179	0.9771	0.9901	(86)
MIT	19.7738	19.9673	20.2407	20.5753	20.8234	20.9535	20.9898	20.9851	20.9061	20.5927	20.1326	19.7485	(87)
Th 2	19.9372	19.9411	19.9451	19.9648	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9608	19.9529	(88)
util rest of house	0.9843	0.9707	0.9420	0.8717	0.7367	0.5390	0.3624	0.4013	0.6507	0.8895	0.9699	0.9873	(89)
MIT 2	18.8398	19.0330	19.3023	19.6337	19.8513	19.9460	19.9650	19.9633	19.9178	19.6590	19.2136	18.8273	(90)
Living area fraction									fLA = Living area / (4) =				0.1833 (91)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	19.0109	19.2042	19.4742	19.8063	20.0295	20.1306	20.1528	20.1505	20.0989	19.8301	19.3820	18.9961 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0109	19.2042	19.4742	19.8063	20.0295	20.1306	20.1528	20.1505	20.0989	19.8301	19.3820	18.9961 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9804	0.9652	0.9352	0.8669	0.7402	0.5533	0.3816	0.4209	0.6618	0.8850	0.9647	0.9840	(94)
Useful gains	772.3655	870.8739	926.2624	920.3948	812.6636	589.6244	390.0496	410.0566	614.1393	750.4588	744.7002	734.3559	(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	1683.1606	1629.8366	1472.1344	1211.5999	922.3449	612.4205	393.4075	415.3065	664.2708	1022.0735	1370.2611	1664.8064	(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	677.6316	510.0229	406.1287	209.6677	81.6029	0.0000	0.0000	0.0000	0.0000	202.0814	450.4039	692.2552	(98)
Space heating													
Space heating per m2													(98) / (4) = 33.2694 (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 %)	90.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3588.6602	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	677.6316	510.0229	406.1287	209.6677	81.6029	0.0000	0.0000	0.0000	0.0000	202.0814	450.4039	692.2552	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	752.9239	566.6922	451.2542	232.9641	90.6698	0.0000	0.0000	0.0000	0.0000	224.5348	500.4488	769.1724	(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	154.4972	115.6620	92.3764	48.6931	21.4964	6.0931	0.4298	29.4114	51.9734	96.2941	131.6911	153.4719	(64)
Efficiency of water heater (217)m	89.4275	89.4299	89.4286	89.4189	89.3575	87.0000	87.0000	87.0000	87.0000	89.0095	89.3033	89.4403	(216)
Fuel for water heating, kWh/month	172.7626	129.3325	103.2963	54.4551	24.0566	7.0036	0.4941	33.8062	59.7395	108.1841	147.4649	171.5914	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3588.6602 (211)
Space heating fuel - secondary													0.0000 (215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.0340, total flow = 37.0000, SFP = 0.2712)		
mechanical ventilation fans (SFP = 0.2712)		82.3430 (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		207.3430 (231)
Electricity for lighting (calculated in Appendix L)		400.1551 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 0.76 * 1068 * 1.00) =	-649.3869	-649.3869 (233)
Total delivered energy for all uses		4558.9584 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3588.6602	3.4800	124.8854	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1012.1868	3.4800	35.2241	(247)
Mechanical ventilation fans	82.3430	13.1900	10.8610	(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	400.1551	13.1900	52.7805	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-649.3869	13.1900	-85.6541	(252)
Total energy cost			274.5844	(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] =	0.8117 (257)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP value 88.6769
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	3588.6602	0.2160	775.1506 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1012.1868	0.2160	218.6324 (264)
Space and water heating			993.7830 (265)
Pumps and fans	207.3430	0.5190	107.6110 (267)
Energy for lighting	400.1551	0.5190	207.6805 (268)
Energy saving/generation technologies			
PV Unit	-649.3869	0.5190	-337.0318 (269)
Total kg/year			972.0427 (272)
CO2 emissions per m2			10.0100 (273)
EI value			90.8324
EI rating			91 (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	49.2900 (1b)	x 2.4800 (2b)	= 122.2392 (1b) - (3b)
First floor	47.7900 (1c)	x 2.6500 (2c)	= 126.6435 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	97.0800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 248.8827 (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											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2313 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.2659	0.2428	0.2370	0.2313	0.2428	0.2139	0.2255	0.2139	0.2139	0.2313	0.2255	0.2370 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5159	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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)			13.1700	1.3258	17.4602		(27)
French Doors (Uw = 1.50)			5.6700	1.4151	8.0236		(27)
Ground Floor			49.2900	0.1200	5.9148	75.0000	3696.7500 (28a)
External Walls	104.0900	20.9400	83.1500	0.1900	15.7985	60.0000	4989.0000 (29a)
Pitched Cold Roof	47.7900		47.7900	0.1000	4.7790	9.0000	430.1100 (30)
Bay Roof	1.5000		1.5000	0.1000	0.1500	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			202.6700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	55.4861			(32)
Party Wall			48.2200	0.0000	0.0000	110.0000	5304.2000 (32)
Internal Wall - Masonry			54.3500			75.0000	4076.2500 (32c)
Internal Wall - Timber			68.2500			9.0000	614.2500 (32c)
Internal Floor			47.7900			18.0000	860.2200 (32d)
Internal Ceiling			47.7900			18.0000	860.2200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	20844.5000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							214.7147 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.1808 (36)
Total fabric heat loss						(33) + (36) =	69.6669 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.3746	Feb 41.0656	Mar 41.0656	Apr 41.0656	May 41.0656	Jun 41.0656	Jul 41.0656	Aug 41.0656	Sep 41.0656	Oct 41.0656	Nov 41.0656	Dec 41.0656 (38)
Heat transfer coeff	112.0415	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326	110.7326 (39)
Average = Sum(39)m / 12 =												110.8416 (39)
HLP	Jan 1.1541	Feb 1.1406	Mar 1.1406	Apr 1.1406	May 1.1406	Jun 1.1406	Jul 1.1406	Aug 1.1406	Sep 1.1406	Oct 1.1406	Nov 1.1406	Dec 1.1406 (40)
HLP (average)												1.1418 (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	2.7108 (42)
Average daily hot water use (litres/day)	98.5815 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	108.4397	104.4964	100.5531	96.6099	92.6666	88.7234	88.7234	92.6666	96.6099	100.5531	104.4964	108.4397	(44)
Energy content (annual)	160.8129	140.6480	145.1361	126.5332	121.4116	104.7690	97.0839	111.4051	112.7357	131.3826	143.4143	155.7387	(45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1551.0710	(45)
Water storage loss:	24.1219	21.0972	21.7704	18.9800	18.2117	15.7153	14.5626	16.7108	16.9104	19.7074	21.5122	23.3608	(46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	18.8122	16.9451	18.6538	17.8682	18.3243	17.5723	18.0579	18.2306	17.7335	18.5149	18.0820	18.7609	(61)
Total heat required for water heating calculated for each month	179.6250	157.5931	163.7899	144.4013	139.7359	122.3413	115.1418	129.6358	130.4692	149.8975	161.4963	174.4996	(62)
Aperture area of solar collector													(H1)
Zero-loss collector efficiency													(H2)
Collector heat loss coefficient													(H3)
Collector 2nd order heat loss coefficient													(H3a)
Collector effective heat loss coefficient													(H3b)
Collector performance ratio													(H4)
Annual solar radiation per m2													(H5)
Overshading factor													(H6)
Solar energy available													(H7)
Adjustment factor for showers													(H7a)
Solar-to-load ratio													(H8)
Utilisation factor													(H9)
Collector performance factor													(H10)
Dedicated solar storage volume													(H11)
Effective solar volume													(H13)
Daily hot water demand													(H14)
Volume ratio Veff/V													(H15)
Solar storage volume factor													(H16)
Solar input													(H17)
Solar input	-30.8555	-42.3435	-71.9399	-98.6708	-117.6463	-123.7308	-122.0517	-106.8822	-84.1304	-57.7708	-35.0969	-25.0407	(63)
Solar input (sum of months) = Sum (63)m =													(63)
Output from w/h	148.7695	115.2496	91.8500	45.7306	22.0896	0.0000	0.0000	22.7536	46.3388	92.1267	126.3994	149.4589	(64)
Total per year (kWh/year) = Sum (64)m =													(64)
Heat gains from water heating, kWh/month	58.1733	51.0017	52.9212	46.5393	44.9504	39.2288	36.7949	41.5999	41.9180	48.3134	52.2058	56.4733	(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	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	162.6480	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	56.6461	50.3126	40.9169	30.9767	23.1555	19.5488	21.1232	27.4567	36.8524	46.7926	54.6138	58.2205	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	375.4013	379.2968	369.4803	348.5821	322.2019	297.4082	280.8445	276.9490	286.7656	307.6637	334.0440	358.8376	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	53.9756	(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)	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	-108.4320	(71)
Water heating gains (Table 5)	78.1900	75.8954	71.1307	64.6379	60.4172	54.4844	49.4555	55.9138	58.2194	64.9374	72.5080	75.9050	(72)
Total internal gains	621.4290	616.6964	592.7195	555.3884	516.9662	482.6331	462.6148	471.5112	493.0290	530.5853	572.3574	604.1547	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g or Table 6c	FF or Table 6c	Access factor Table 6d	Gains W	
North	6.3900	14.6401	0.6300	0.7000	0.7700		28.5901	(74)
East	3.0000	27.3735	0.6300	0.7000	0.7700		25.0971	(76)
South	2.8800	61.3950	0.6300	0.7000	0.7700		54.0377	(78)
West	0.9000	27.3735	0.6300	0.7000	0.7700		7.5291	(80)
South	5.6700	61.3950	0.6300	0.7000	0.7700		106.3868	(78)

Solar gains	221.6408	312.8001	435.9162	572.2033	637.7440	686.6868	657.8700	589.2837	508.6164	371.2684	254.9877	183.7266	(83)
Total gains	843.0698	929.4965	1028.6357	1127.5918	1154.7103	1169.3199	1120.4848	1060.7949	1001.6454	901.8537	827.3451	787.8814	(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)														
tau	51.6785	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894	52.2894		
alpha	4.4452	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860	4.4860		
util living area	0.9798	0.9683	0.9346	0.8511	0.6962	0.4818	0.3247	0.3324	0.5982	0.8561	0.9586	0.9833	(86)	
MIT	19.9849	20.1335	20.4058	20.7061	20.9106	20.9864	20.9982	20.9981	20.9651	20.7550	20.3431	19.9727	(87)	
Th 2	19.9569	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	19.9678	(88)	
util rest of house														
	0.9742	0.9597	0.9170	0.8130	0.6274	0.3910	0.2239	0.2261	0.5028	0.8086	0.9452	0.9785	(89)	
MIT 2	19.0638	19.2173	19.4785	19.7517	19.9164	19.9631	19.9675	19.9675	19.9534	19.8008	19.4234	19.0610	(90)	
Living area fraction									fLA = Living area / (4) =				0.1833	(91)

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	19.2326	19.3852	19.6485	19.9266	20.0986	20.1506	20.1564	20.1564	20.1388	19.9757	19.5920	19.2281 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2326	19.3852	19.6485	19.9266	20.0986	20.1506	20.1564	20.1564	20.1388	19.9757	19.5920	19.2281 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9692	0.9537	0.9105	0.8113	0.6367	0.4074	0.2424	0.2456	0.5194	0.8091	0.9391	0.9740	(94)
Useful gains	817.0873	886.4369	936.5597	914.8497	735.1725	476.4063	271.6445	260.5641	520.2530	729.6484	776.9711	767.4261	(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	1561.0286	1515.3983	1356.3035	1110.2698	786.0435	481.7517	272.0042	260.9286	535.8108	883.1691	1239.3154	1520.1483	(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	553.4923	422.6620	312.2893	140.7025	37.8481	0.0000	0.0000	0.0000	0.0000	114.2193	332.8878	560.0253	(98)
Space heating												2474.1267	(98)
Space heating per m2											(98) / (4) =	25.4854	(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 %)	90.0000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2749.0297	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	553.4923	422.6620	312.2893	140.7025	37.8481	0.0000	0.0000	0.0000	0.0000	114.2193	332.8878	560.0253	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	614.9914	469.6245	346.9882	156.3361	42.0534	0.0000	0.0000	0.0000	0.0000	126.9104	369.8754	622.2503	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	148.7695	115.2496	91.8500	45.7306	22.0896	0.0000	0.0000	22.7536	46.3388	92.1267	126.3994	149.4589	(64)
Efficiency of water heater (217)m	89.3473	89.3400	89.3002	89.2451	88.8706	87.0000	87.0000	87.0000	87.0000	88.6354	89.1539	89.3509	(216)
Fuel for water heating, kWh/month	166.5070	129.0012	102.8554	51.2415	24.8559	0.0000	0.0000	26.1536	53.2630	103.9389	141.7766	167.2717	(219)
Water heating fuel used												966.8648	(219)
Annual totals kWh/year													
Space heating fuel - main system												2749.0297	(211)
Space heating fuel - secondary												0.0000	(215)

Electricity for pumps and fans:

(MEV)Decentralised, Database: total watage = 10.0340, total flow = 37.0000, SFP = 0.2712)		
mechanical ventilation fans (SFP = 0.2712)		82.3430 (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		207.3430 (231)
Electricity for lighting (calculated in Appendix L)		400.1551 (232)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 0.76 * 1246 * 1.00) =	-757.5778	-757.5778 (233)
Total delivered energy for all uses		3565.8149 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2749.0297	3.6300	99.7898	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	966.8648	3.6300	35.0972	(247)
Mechanical ventilation fans	82.3430	19.4400	16.0075	(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	400.1551	19.4400	77.7902	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-757.5778	19.4400	-147.2731	(252)
Total energy cost			200.7115	(255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - main system 1	2749.0297	0.2160	593.7904 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	966.8648	0.2160	208.8428 (264)
Space and water heating			802.6332 (265)
Pumps and fans	207.3430	0.5190	107.6110 (267)
Energy for lighting	400.1551	0.5190	207.6805 (268)
Energy saving/generation technologies			
PV Unit	-757.5778	0.5190	-393.1829 (269)
Total kg/year			724.7419 (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	2749.0297	1.2200	3353.8162 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	966.8648	1.2200	1179.5751 (264)
Space and water heating			4533.3913 (265)
Pumps and fans	207.3430	3.0700	636.5431 (267)
Energy for lighting	400.1551	3.0700	1228.4762 (268)
Energy saving/generation technologies			
PV Unit	-757.5778	3.0700	-2325.7638 (269)
Primary energy kWh/year			4072.6469 (272)
Primary energy kWh/m2/year			41.9515 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached 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	214.7 (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	657.05 (P1)
Transmission heat loss coefficient	69.67 (37)
Summer heat loss coefficient	726.72 (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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.3900	87.1704	0.6300	0.7000	0.9000	198.9728
East	3.0000	125.2818	0.6300	0.7000	0.9000	134.2557
South	2.8800	118.5567	0.6300	0.7000	0.9000	121.9669
West	0.9000	125.2818	0.6300	0.7000	0.9000	40.2767
South	5.6700	118.5567	0.6300	0.7000	0.9000	240.1224

total: 735.5946

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	786	736	671	
Total summer gains	480	460	469	
	1266	1195	1140	(P5)

Summer gain/loss ratio	1.74	1.64	1.57	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 214.7)	0.50	0.50	0.50	
Threshold temperature	17.64	19.44	19.37	(P7)

Likelihood of high internal temperature Not significant Not significant Not significant

Assessment of likelihood of high internal temperature: Not significant

PREDICTED ENERGY ASSESSMENT

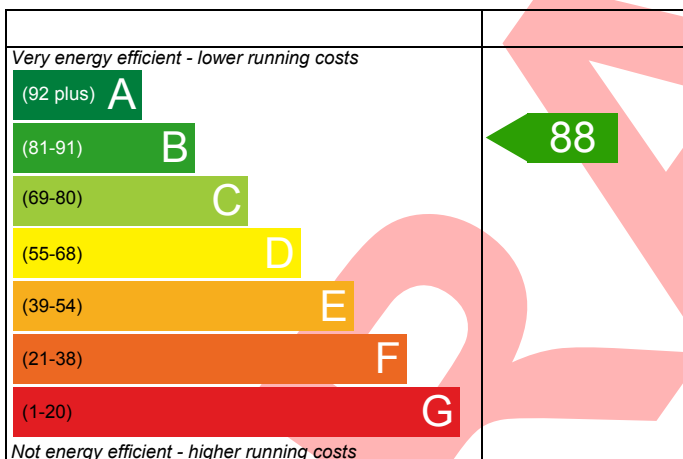
Plot 4, Long Copse Lane,
Emsworth,
Hampshire,
PO10 7UR

Dwelling type: House, Semi-Detached
Date of assessment: 10/05/2022
Produced by: Scott Spearing
Total floor area: 97.08 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

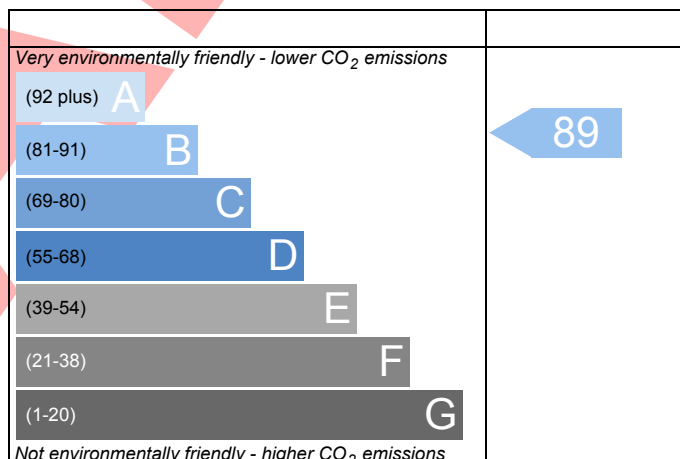


England

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.