



SAP Report Submission for Building Regulations Compliance

Client: Metis Build Ltd

Project: Plot 2, 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 2			Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref			
Property	Plot 2, Long Copse Lane, Emsworth, Hampshire, PO10 7UR				
SAP Rating	89 B	DER	12.74	TER	16.06
Environmental	88 B	% DER<TER	20.67		
CO ₂ Emissions (t/year)	1.39	DFEE	51.85	TFEE	58.93
General Requirements Compliance	Pass	% DFEE<TFEE	12.01		
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)	16.06	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.74	kgCO ₂ /m ²	Pass
	-3.32 (-20.7%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.93	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	51.85	kWh/m ² /yr	
	-7.0 (-11.9%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	Pass
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	Pass
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	Pass
Openings	1.42 (max. 2.00)	1.60 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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

Calculation Type: New Build (As Designed)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

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

Pass

Primary pipework insulated

Yes

Pass

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

Cylinderstat

Pass

Independent timer for DHW

Pass

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power

0.2000 0.1800

Maximum

0.7

Pass

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North

9.32 m², No overhang

Windows facing East

3.21 m², No overhang

Windows facing South

14.90 m², No overhang

Windows facing West

11.92 m², No overhang

Air change rate

8.00 ach

Blinds/curtains

None

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

5.00 (design value)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.10

W/m²K

Roof U-value

0.10

W/m²K

Floor U-value

0.12

W/m²K

Photovoltaic array

1.36

kW

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

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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, Detached
2.0 Number of Storeys	2
3.0 Date Built	2021
4.0 Sheltered Sides	0
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	45.61 m	82.63 m ²	2.48 m
1st Storey:	35.63 m	72.70 m ²	2.65 m

7.0 Living Area	24.64	m ²
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8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	166.66	kJ/m ² K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.19	60.00	200.73	159.28
Garage Wall	Timber Frame	Timber framed wall (one layer of plasterboard)	0.17	9.00	6.80	6.80

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - Masonry	Dense block, plasterboard on dabs	75.00	72.66
Internal Wall - Timber	Plasterboard on timber frame	9.00	140.20

10.0 External Roofs

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Cold Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	78.28	78.28
Bay Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	4.35	4.35

10.2 Internal Ceilings

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	72.70

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	82.63

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	72.70

12.0 Opening Types

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

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Front Door	Solid Door	[1] External Walls	North							2.10	
Front Elevation	Window	[1] External Walls	North	None	0.00					9.32	
Side Elevation	Window	[1] External Walls	East	None	0.00					1.26	
Side Door	Window	[1] External Walls	East	None	0.00					1.95	
Rear French Doors	Window	[1] External Walls	South	None	0.00					5.70	
Rear Elevation	Window	[1] External Walls	South	None	0.00					9.20	
Side Elevation	Window	[1] External Walls	West	None	0.00					11.92	

14.0 Conservatory

None

15.0 Draught Proofing

100

%

16.0 Draught Lobby

No

17.0 Thermal Bridging

Calculate Bridges

17.1 List of Bridges

Source Type	Bridge Type	Length	Psi	Imported	Reference:
Independently assessed	E2 Other lintels (including other steel lintels)	27.82	0.050	Yes	Hi-Therms
Table K1 - Approved	E3 Sill	26.82	0.040	Yes	
Table K1 - Approved	E4 Jamb	55.80	0.050	No	
Table K1 - Approved	E5 Ground floor (normal)	45.61	0.160	Yes	
Table K1 - Approved	E6 Intermediate floor within a dwelling	35.63	0.070	Yes	
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	41.15	0.060	No	
Table K1 - Approved	E12 Gable (insulation at ceiling level)	10.91	0.240	No	
Table K1 - Approved	E16 Corner (normal)	43.12	0.090	No	
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	22.62	-0.090	No	

Y-value	0.059	W/m²K
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18.0 Pressure Testing

Yes

Designed AP₅₀

5.00

m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀

m³/(h.m²) @ 50 Pa

SUMMARY FOR INPUT DATA

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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	5

20.0 Fans, Open Fireplaces, Flues

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

21.0 Fixed Cooling System

No

22.0 Lighting

Internal

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

External

External lights fitted	No
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23.0 Electricity Tariff

Standard

24.0 Main Heating 1

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

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PCDF Controls	0
Delayed Start Stat	No
Sap Code	2110
Flue Type	Balanced
Fan Assisted Flue	Yes
Is MHS Pumped	Pump in heated space
Heat Emitter	Radiators
Flow Temperature	Normal (> 45°C)
25.0 Main Heating 2	None

Community Heating	None
28.0 Water Heating	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	Hot Water Cylinder
Cylinder Stat	Yes
Cylinder In Heated Space	Yes
Independent Time Control	Yes
Insulation Type	Measured Loss
Cylinder Volume	250.00
Loss	2.25
Pipes insulation	Fully insulated primary pipework

L
kWh/day

31.0 Thermal Store	None
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32.0 Photovoltaic Unit		One Dwelling		
PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
1.02	South	45°	None Or Little	Yes
0.34	East	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£42	B 90	

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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Client	Metis Build Ltd, METIS BUILD
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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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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 = 82.63 m², Perimeter = 45.61 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

Detached House, total floor area 155 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.06 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.74 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.42 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Data from database

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

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.25 kWh/day

Permitted by DBSCG 2.56 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.2000 0.1800

Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average

Windows facing North: 9.32 m², No overhang

Windows facing East: 3.21 m², No overhang

Windows facing South: 14.90 m², No overhang

Windows facing West: 11.92 m², No overhang

Air change rate: 8.00 ach

Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K

Roof U-value 0.10 W/m²K

Floor U-value 0.12 W/m²K

Photovoltaic array 1.36 kW

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	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			33.6500	1.3258	44.6117		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			82.6300	0.1200	9.9156	75.0000	6197.2500 (28a)					
External Walls	200.7300	41.4500	159.2800	0.1900	30.2632	60.0000	9556.8000 (29a)					
Garage Wall	6.8000		6.8000	0.1700	1.1560	9.0000	61.2000 (29a)					
Pitched Cold Roof	78.2800		78.2800	0.1000	7.8280	9.0000	704.5200 (30)					
Bay Roof	4.3500		4.3500	0.1000	0.4350	9.0000	39.1500 (30)					
Total net area of external elements Aum(A, m2)			372.7900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		105.6356		(33)					
Internal Wall - Masonry			72.6600			75.0000	5449.5000 (32c)					
Internal Wall - Timber			140.2000			9.0000	1261.8000 (32c)					
Internal Floor			72.7000			18.0000	1308.6000 (32d)					
Internal Ceiling			72.7000			18.0000	1308.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		25887.4200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							166.6608 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9779 (36)					
Total fabric heat loss						(33) + (36) =	127.6135 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 74.6203	Feb 73.8003	Mar 72.9803	Apr 68.8803	May 68.0603	Jun 65.6003	Jul 65.6003	Aug 65.6003	Sep 65.6003	Oct 68.0603	Nov 69.7003	Dec 71.3403 (38)
Heat transfer coeff	202.2338	201.4138	200.5938	196.4938	195.6738	193.2138	193.2138	193.2138	193.2138	195.6738	197.3138	198.9538 (39)
Average = Sum(39)m / 12 =												196.7671 (39)
HLP	Jan 1.3020	Feb 1.2967	Mar 1.2914	Apr 1.2650	May 1.2597	Jun 1.2439	Jul 1.2439	Aug 1.2439	Sep 1.2439	Oct 1.2597	Nov 1.2703	Dec 1.2808 (40)
HLP (average)												1.2668 (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	2.9422 (42)
Average daily hot water use (litres/day)	104.0778 (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	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856	(44)
Energy conte	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217	(45)
Energy content (annual)	Total = Sum (45)m =											1637.5490	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4668	22.2734	22.9842	20.0382	19.2271	16.5915	15.3745	17.6425	17.8532	20.8061	22.7115	24.6633	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.2150	(55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	178.5438	177.9831	199.6350	210.3722	225.3491	(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	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	178.5438	177.9831	199.6350	210.3722	225.3491	(64)
Heat gains from water heating, kWh/month	105.1934	93.3978	99.6902	91.5876	91.3620	83.9475	82.8221	87.8494	86.7441	94.8622	97.5135	103.4121	(65)
Total per year (kWh/year) = Sum (64)m =													2354.9200 (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	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.0865	25.8344	21.0099	15.9059	11.8898	10.0379	10.8463	14.0984	18.9229	24.0269	28.0430	29.8949	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.2623	329.6479	321.1163	302.9537	280.0266	258.4783	244.0827	240.6972	249.2287	267.3914	290.3185	311.8668	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	(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)	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	(71)
Water heating gains (Table 5)	141.3889	138.9848	133.9922	127.2050	122.7984	116.5938	111.3200	118.0771	120.4779	127.5030	135.4354	138.9948	(72)
Total internal gains	566.8711	564.6004	546.2519	516.1978	484.8481	455.2433	436.3823	443.0060	458.7629	489.0546	523.9303	550.8898	(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					9.3200	10.6334	0.6300	0.7000			0.7700			30.2872 (74)
East					3.2100	19.6403	0.6300	0.7000			0.7700			19.2674 (76)
South					9.2000	46.7521	0.6300	0.7000			0.7700			131.4500 (78)
West					11.9200	19.6403	0.6300	0.7000			0.7700			71.5477 (80)
South					5.7000	46.7521	0.6300	0.7000			0.7700			81.4418 (78)
Solar gains	333.9941	584.1959	835.0566	1086.6435	1258.8267	1266.5317	1214.1899	1084.1774	922.4732	655.7646	402.9483	283.8889	(83)	
Total gains	900.8652	1148.7963	1381.3085	1602.8413	1743.6749	1721.7750	1650.5722	1527.1834	1381.2361	1144.8193	926.8786	834.7788	(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	35.5576	35.7024	35.8483	36.5963	36.7497	37.2176	37.2176	37.2176	37.2176	36.7497	36.4442	36.1438	
alpha	3.3705	3.3802	3.3899	3.4398	3.4500	3.4812	3.4812	3.4812	3.4812	3.4500	3.4296	3.4096	
util living area	0.9914	0.9804	0.9563	0.8984	0.7915	0.6355	0.4889	0.5414	0.7629	0.9348	0.9838	0.9934	(86)
MIT	19.0344	19.3233	19.7406	20.2516	20.6487	20.8858	20.9654	20.9503	20.7758	20.2289	19.5404	19.0014	(87)
Th 2	19.8393	19.8434	19.8476	19.8683	19.8725	19.8850	19.8850	19.8850	19.8850	19.8725	19.8642	19.8559	(88)
util rest of house	0.9894	0.9758	0.9457	0.8735	0.7406	0.5498	0.3759	0.4263	0.6886	0.9135	0.9792	0.9918	(89)
MIT 2	17.2303	17.6518	18.2545	18.9854	19.5123	19.7974	19.8683	19.8588	19.6893	18.9727	17.9831	17.1922	(90)
Living area fraction	17.5165	17.9169	18.4903	19.1862	19.6925	19.9700	20.0424	20.0320	19.8616	19.1720	18.2302	17.4792	(92)
MIT	17.5165	17.9169	18.4903	19.1862	19.6925	19.9700	20.0424	20.0320	19.8616	19.1720	18.2302	17.4792	(93)
Temperature adjustment													0.0000
adjusted MIT	17.5165	17.9169	18.4903	19.1862	19.6925	19.9700	20.0424	20.0320	19.8616	19.1720	18.2302	17.4792	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9829	0.9645	0.9288	0.8550	0.7314	0.5568	0.3926	0.4424	0.6869	0.8960	0.9693	0.9865	(94)
Useful gains	885.4490	1108.0197	1282.9652	1370.4231	1275.3018	958.7001	648.0427	675.6301	948.7198	1025.7484	898.4553	823.4715	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fracti	2672.8261	2621.7856	2405.1718	2021.1835	1563.9288	1037.5650	665.1113	701.7434	1113.2298	1677.3169	2196.1337	2641.9482 (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	1329.8085	1017.2506	834.9217	468.5475	214.7384	0.0000	0.0000	0.0000	0.0000	484.7669	934.3284	1352.9467 (98)
Space heating												6637.3089 (98)
Space heating per m2											(98) / (4) =	42.7304 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												7325.9480 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1329.8085	1017.2506	834.9217	468.5475	214.7384	0.0000	0.0000	0.0000	0.0000	484.7669	934.3284	1352.9467 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1467.7798	1122.7932	921.5471	517.1606	237.0181	0.0000	0.0000	0.0000	0.0000	535.0629	1031.2676	1493.3186 (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	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	177.9831	199.6350	210.3722	225.3491	225.3491 (64)
Efficiency of water heater	88.8411	88.6214	88.1891	87.1989	85.2538	79.9000	79.9000	79.9000	79.9000	87.1940	88.4238	79.9000 (216)
(217)m	88.8411	88.6214	88.1891	87.1989	85.2538	79.9000	79.9000	79.9000	79.9000	87.1940	88.4238	88.9002 (217)
Fuel for water heating, kWh/month	259.6841	229.6519	242.8365	220.8170	221.8178	212.2306	204.5357	223.4591	222.7573	228.9551	237.9136	253.4856 (219)
Water heating fuel used												2758.1444 (219)
Annual totals kWh/year												
Space heating fuel - main system												7325.9480 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)												
mechanical ventilation fans (SFP = 0.2681)												130.0468 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												205.0468 (231)
Electricity for lighting (calculated in Appendix L)												513.6771 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.02 * 1068 * 1.00) =									-871.5455			-1103.5697
PV Unit 1 (0.80 * 0.34 * 853 * 1.00) =									-232.0241			-1103.5697 (233)
Total delivered energy for all uses												9699.2467 (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	7325.9480	0.2160	1582.4048 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2758.1444	0.2160	595.7592 (264)
Space and water heating			2178.1640 (265)
Pumps and fans	205.0468	0.5190	106.4193 (267)
Energy for lighting	513.6771	0.5190	266.5984 (268)
Energy saving/generation technologies			
PV Unit	-1103.5697	0.5190	-572.7527 (269)
Total CO2, kg/year			1978.4290 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.7400 (273)

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

DER			12.7400 ZC1
Total Floor Area		TFA	155.3300
Assumed number of occupants		N	2.9422
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			12.4468 ZC2
CO2 emissions from cooking, equation (L16)			1.2207 ZC3
Total CO2 emissions			26.4075 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			26.4075 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	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1006 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3506 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3506 (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	0.4470	0.4383	0.4295	0.3857	0.3769	0.3331	0.3331	0.3243	0.3506	0.3769	0.3944	0.4120 (22b)
Effective ac	0.5999	0.5960	0.5922	0.5744	0.5710	0.5555	0.5555	0.5526	0.5615	0.5710	0.5778	0.5849 (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)			36.7400	1.3258	48.7083		(27)
Ground Floor			82.6300	0.1300	10.7419		(28a)
External Walls	200.7300	38.8400	161.8900	0.1800	29.1402		(29a)
Garage Wall	6.8000		6.8000	0.1800	1.2240		(29a)
Pitched Cold Roof	78.2800		78.2800	0.1300	10.1764		(30)
Bay Roof	4.3500		4.3500	0.1300	0.5655		(30)
Total net area of external elements Aum(A, m ²)			372.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.6563		(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)							17.7882 (36)
Total fabric heat loss						(33) + (36) =	120.4445 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	78.7094	78.2003	77.7014	75.3578	74.9193	72.8781	72.8781	72.5001	73.6643	74.9193	75.8063	76.7337 (38)
Heat transfer coeff	199.1539	198.6449	198.1459	195.8023	195.3638	193.3226	193.3226	192.9446	194.1088	195.3638	196.2509	197.1782 (39)
Average = Sum(39)m / 12 =												195.8002 (39)
HLP	1.2821	1.2789	1.2756	1.2606	1.2577	1.2446	1.2446	1.2422	1.2497	1.2577	1.2634	1.2694 (40)
HLP (average)												1.2605 (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												2.9422 (42)
Average daily hot water use (litres/day)												104.0778 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856 (44)
Energy conte	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217 (45)
Energy content (annual)											Total = Sum(45)m =	1637.5490 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.4668	22.2734	22.9842	20.0382	19.2271	16.5915	15.3745	17.6425	17.8532	20.8061	22.7115	24.6633 (46)	
Water storage loss:												
Store volume												250.0000 (47)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day):												1.8903 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
224.6856	198.0829	208.1348	186.7235	183.0875	163.7458	157.4034	172.5232	172.1567	193.6144	204.5458	219.3285	(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	(63)
Solar input (sum of months) = Sum(63)m =											0.0000	(63)
Output from w/h												
224.6856	198.0829	208.1348	186.7235	183.0875	163.7458	157.4034	172.5232	172.1567	193.6144	204.5458	219.3285	(64)
Heat gains from water heating, kWh/month												
100.3769	89.0474	94.8737	86.9265	86.5455	79.2864	78.0056	83.0329	82.0830	90.0457	92.8524	98.5956	(65)
Total per year (kWh/year) = Sum(64)m =											2284.0322	(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	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
29.0865	25.8344	21.0099	15.9059	11.8898	10.0379	10.8463	14.0984	18.9229	24.0269	28.0430	29.8949	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
326.2623	329.6479	321.1163	302.9537	280.0266	258.4783	244.0827	240.6972	249.2287	267.3914	290.3185	311.8668	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	(71)
Water heating gains (Table 5)												
134.9152	132.5110	127.5185	120.7312	116.3246	110.1200	104.8462	111.6033	114.0042	121.0292	128.9616	132.5210	(72)
Total internal gains												
560.3974	558.1266	539.7781	509.7241	478.3744	448.7695	429.9086	436.5323	452.2891	482.5809	517.4565	544.4161	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
North		8.7000	10.6334	0.6300	0.7000	0.7700	28.2724 (74)
East		3.0000	19.6403	0.6300	0.7000	0.7700	18.0070 (76)
South		13.9000	46.7521	0.6300	0.7000	0.7700	198.6037 (78)
West		11.1400	19.6403	0.6300	0.7000	0.7700	66.8658 (80)

Solar gains	311.7490	545.3210	779.5625	1014.5250	1175.3465	1182.5640	1133.6830	1012.2494	861.2041	612.1487	376.1172	264.9765 (83)
Total gains	872.1463	1103.4476	1319.3406	1524.2491	1653.7209	1631.3336	1563.5916	1448.7817	1313.4932	1094.7295	893.5737	809.3925 (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	54.1632	54.3020	54.4387	55.0903	55.2139	55.7969	55.9062	55.5709	55.2139	54.9644	54.7059	
alpha	4.6109	4.6201	4.6292	4.6727	4.6809	4.7198	4.7271	4.7047	4.6809	4.6643	4.6471	
util living area												
0.9985	0.9952	0.9851	0.9505	0.8604	0.6959	0.5296	0.5877	0.8326	0.9737	0.9963	0.9989	(86)
MIT	19.5505	19.7594	20.0699	20.4545	20.7663	20.9394	20.9866	20.9785	20.8541	20.4273	19.9114	19.5182 (87)
Th 2	19.8549	19.8574	19.8600	19.8719	19.8741	19.8845	19.8845	19.8864	19.8805	19.8741	19.8696	19.8649 (88)
util rest of house												
0.9979	0.9935	0.9796	0.9318	0.8093	0.5986	0.4026	0.4576	0.7542	0.9603	0.9947	0.9985	(89)
MIT 2	17.9286	18.2351	18.6871	19.2399	19.6495	19.8453	19.8798	19.8780	19.7662	19.2135	18.4665	17.8883 (90)
Living area fraction												
MIT	18.1859	18.4769	18.9064	19.4326	19.8266	20.0188	20.0554	20.0525	19.9387	19.4061	18.6957	18.1468 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1859	18.4769	18.9064	19.4326	19.8266	20.0188	20.0554	20.0525	19.9387	19.4061	18.6957	18.1468 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0.9966	0.9904	0.9732	0.9225	0.8068	0.6113	0.4228	0.4780	0.7589	0.9525	0.9922	0.9976	(94)
Useful gains	869.2231	1092.8817	1283.9956	1406.1656	1334.1669	997.2430	661.0353	692.5434	996.8658	1042.7645	886.6051	807.4481 (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												
2765.4358	2696.9881	2458.2864	2062.3059	1587.6530	1047.5847	667.9997	704.7398	1133.3498	1720.3880	2275.6641	2750.0137	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh												
1410.7822	1077.9595	873.6724	472.4210	188.5937	0.0000	0.0000	0.0000	0.0000	504.1518	1000.1224	1445.2688	(98)
Space heating												6972.9719 (98)
Space heating per m2												(98) / (4) = 44.8913 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													7457.7240	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1410.7822	1077.9595	873.6724	472.4210	188.5937	0.0000	0.0000	0.0000	0.0000	504.1518	1000.1224	1445.2688	(98)	
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)	
Space heating fuel (main heating system)	1508.8580	1152.8978	934.4090	505.2631	201.7045	0.0000	0.0000	0.0000	0.0000	539.1998	1069.6497	1545.7421	(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	224.6856	198.0829	208.1348	186.7235	183.0875	163.7458	157.4034	172.5232	172.1567	193.6144	204.5458	219.3285	(64)	
Efficiency of water heater (217)m	88.8631	88.6547	88.2241	87.1883	84.8929	79.8000	79.8000	79.8000	79.8000	87.2537	88.4855	88.9289	(216)	
Fuel for water heating, kWh/month	252.8448	223.4318	235.9162	214.1613	215.6689	205.1953	197.2474	216.1945	215.7352	221.8983	231.1632	246.6336	(219)	
Water heating fuel used												2676.0905	(219)	
Annual totals kWh/year														
Space heating fuel - main system												7457.7240	(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)													513.6771	(232)
Total delivered energy for all uses													10722.4916	(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	7457.7240	0.2160	1610.8684 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2676.0905	0.2160	578.0356 (264)
Space and water heating			2188.9039 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	513.6771	0.5190	266.5984 (268)
Total CO2, kg/m2/year			2494.4273 (272)
Emissions per m2 for space and water heating			14.0920 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.7163 (272b)
Emissions per m2 for pumps and fans			0.2506 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.0920 * 1.00) + 1.7163 + 0.2506, rounded to 2 d.p.			16.0600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1006 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3506 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3506 (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	0.4470	0.4383	0.4295	0.3857	0.3769	0.3331	0.3331	0.3243	0.3506	0.3769	0.3944	0.4120 (22b)
Effective ac	0.5999	0.5960	0.5922	0.5744	0.5710	0.5555	0.5555	0.5526	0.5615	0.5710	0.5778	0.5849 (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)			33.6500	1.3258	44.6117		(27)
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)
Ground Floor			82.6300	0.1200	9.9156	75.0000	6197.2500 (28a)
External Walls	200.7300	41.4500	159.2800	0.1900	30.2632	60.0000	9556.8000 (29a)
Garage Wall	6.8000		6.8000	0.1700	1.1560	9.0000	61.2000 (29a)
Pitched Cold Roof	78.2800		78.2800	0.1000	7.8280	9.0000	704.5200 (30)
Bay Roof	4.3500		4.3500	0.1000	0.4350	9.0000	39.1500 (30)
Total net area of external elements Aum(A, m ²)			372.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	105.6356		(33)
Internal Wall - Masonry			72.6600			75.0000	5449.5000 (32c)
Internal Wall - Timber			140.2000			9.0000	1261.8000 (32c)
Internal Floor			72.7000			18.0000	1308.6000 (32d)
Internal Ceiling			72.7000			9.0000	654.3000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25233.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							162.4485 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9779 (36)
Total fabric heat loss						(33) + (36) =	127.6135 (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	78.7094	78.2003	77.7014	75.3578	74.9193	72.8781	72.8781	72.5001	73.6643	74.9193	75.8063	76.7337 (38)
Heat transfer coeff	206.3229	205.8138	205.3148	202.9712	202.5328	200.4915	200.4915	200.1135	201.2778	202.5328	203.4198	204.3472 (39)
Average = Sum(39)m / 12 =												202.9691 (39)
HLP	1.3283	1.3250	1.3218	1.3067	1.3039	1.2907	1.2907	1.2883	1.2958	1.3039	1.3096	1.3156 (40)
HLP (average)												1.3067 (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												2.9422 (42)
Average daily hot water use (litres/day)												104.0778 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217 (45)
Energy content (annual)										Total =	Sum (45)m =	1637.5490 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.0780	31.5540	32.5609	28.3874	27.2384	23.5047	21.7805	24.9935	25.2920	29.4754	32.1747	34.9396 (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	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.0865	25.8344	21.0099	15.9059	11.8898	10.0379	10.8463	14.0984	18.9229	24.0269	28.0430	29.8949 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.2623	329.6479	321.1163	302.9537	280.0266	258.4783	244.0827	240.6972	249.2287	267.3914	290.3185	311.8668 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111 (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)	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889 (71)
Water heating gains (Table 5)	48.4919	46.9554	43.7647	39.4270	36.6108	32.6454	29.2749	33.5934	35.1278	39.6174	44.6870	46.9618 (72)
Total internal gains	470.9741	469.5711	453.0243	425.4199	395.6605	368.2949	351.3373	355.5223	370.4127	398.1691	430.1819	455.8569 (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	9.3200	10.6334	0.6300	0.7000	0.7700	30.2872 (74)
East	3.2100	19.6403	0.6300	0.7000	0.7700	19.2674 (76)
South	9.2000	46.7521	0.6300	0.7000	0.7700	131.4500 (78)
West	11.9200	19.6403	0.6300	0.7000	0.7700	71.5477 (80)
South	5.7000	46.7521	0.6300	0.7000	0.7700	81.4418 (78)

Solar gains	333.9941	584.1959	835.0566	1086.6435	1258.8267	1266.5317	1214.1899	1084.1774	922.4732	655.7646	402.9483	283.8889 (83)
Total gains	804.9682	1053.7670	1288.0809	1512.0633	1654.4872	1634.8266	1565.5271	1439.6997	1292.8859	1053.9337	833.1302	739.7458 (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	33.9720	34.0560	34.1388	34.5330	34.6077	34.9601	34.9601	35.0261	34.8235	34.6077	34.4568	34.3005
alpha	3.2648	3.2704	3.2759	3.3022	3.3072	3.3307	3.3307	3.3351	3.3216	3.3072	3.2971	3.2867
util living area	0.9933	0.9838	0.9625	0.9116	0.8149	0.6689	0.5238	0.5788	0.7953	0.9467	0.9874	0.9949 (86)
MIT	18.8828	19.1766	19.6077	20.1332	20.5692	20.8469	20.9498	20.9295	20.7092	20.1077	19.3885	18.8353 (87)
Th 2	19.8187	19.8213	19.8238	19.8356	19.8378	19.8481	19.8481	19.8500	19.8441	19.8378	19.8333	19.8287 (88)
util rest of house	0.9917	0.9799	0.9533	0.8890	0.7664	0.5815	0.4026	0.4571	0.7240	0.9285	0.9838	0.9937 (89)
MIT 2	17.8955	18.1889	18.6155	19.1314	19.5317	19.7662	19.8312	19.8239	19.6665	19.1195	18.4101	17.8553 (90)
Living area fraction	18.0521	18.3456	18.7729	19.2903	19.6963	19.9376	20.0086	19.9993	19.8319	19.2763	18.5653	18.0108 (92)
Temperature adjustment	18.0521	18.3456	18.7729	19.2903	19.6963	19.9376	20.0086	19.9993	19.8319	19.2763	18.5653	18.0108 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9882	0.9732	0.9425	0.8760	0.7596	0.5890	0.4205	0.4742	0.7231	0.9170	0.9782	0.9909 (94)
Ext temp.	795.4928	1025.5600	1213.9879	1324.6312	1256.6835	962.9054	658.3549	682.6622	934.8514	966.4802	814.9339	733.0278 (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	2837.3734	2767.2952	2519.8068	2108.9407	1619.5130	1070.1422	683.3991	720.2644	1153.7135	1757.2328	2332.2743	2822.1954 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	1519.1592	1170.4461	971.5292	564.7028	269.9451	0.0000	0.0000	0.0000	0.0000	588.3199	1092.4851	1554.3407 (98)
												7730.9280 (98)
												49.7710 (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	1884.6205	1483.6374	1520.8629	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7983	0.8619	0.8312	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1504.4400	1278.8083	1264.1443	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2038.3303	1954.3162	1809.7493	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	384.4010	502.5779	405.9301	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1292.9090	(104)
Intermittency factor (Table 10b)												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	96.1003	125.6445	101.4825	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												323.2273	(107)
Energy for space heating												2.0809	(108)
Energy for space cooling												49.7710	(99)
Total												2.0809	(108)
Dwelling Fabric Energy Efficiency (DFEE)												51.8519	(109)
												51.9	(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	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1006 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3506 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3506 (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	0.4470	0.4383	0.4295	0.3857	0.3769	0.3331	0.3331	0.3243	0.3506	0.3769	0.3944	0.4120 (22b)
Effective ac	0.5999	0.5960	0.5922	0.5744	0.5710	0.5555	0.5555	0.5526	0.5615	0.5710	0.5778	0.5849 (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)			36.7400	1.3258	48.7083		(27)
Ground Floor			82.6300	0.1300	10.7419		(28a)
External Walls	200.7300	38.8400	161.8900	0.1800	29.1402		(29a)
Garage Wall	6.8000		6.8000	0.1800	1.2240		(29a)
Pitched Cold Roof	78.2800		78.2800	0.1300	10.1764		(30)
Bay Roof	4.3500		4.3500	0.1300	0.5655		(30)
Total net area of external elements Aum(A, m ²)			372.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.6563		(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)							17.7882 (36)
Total fabric heat loss						(33) + (36) =	120.4445 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	78.7094	78.2003	77.7014	75.3578	74.9193	72.8781	72.8781	72.5001	73.6643	74.9193	75.8063	76.7337 (38)
Heat transfer coeff	199.1539	198.6449	198.1459	195.8023	195.3638	193.3226	193.3226	192.9446	194.1088	195.3638	196.2509	197.1782 (39)
Average = Sum(39)m / 12 =												195.8002 (39)
HLP	1.2821	1.2789	1.2756	1.2606	1.2577	1.2446	1.2446	1.2422	1.2497	1.2577	1.2634	1.2694 (40)
HLP (average)												1.2605 (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												2.9422 (42)
Average daily hot water use (litres/day)												104.0778 (43)
Daily hot water use	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856 (44)
Energy conte	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217 (45)
Energy content (annual)										Total = Sum(45)m =		1637.5490 (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												

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 (56)
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 (57)
Heat gains from water heating, kWh/month	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)
	36.0780	31.5540	32.5609	28.3874	27.2384	23.5047	21.7805	24.9935	25.2920	29.4754	32.1747	34.9396 (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	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	147.1112	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	29.0865	25.8344	21.0099	15.9059	11.8898	10.0379	10.8463	14.0984	18.9229	24.0269	28.0430	29.8949	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	326.2623	329.6479	321.1163	302.9537	280.0266	258.4783	244.0827	240.6972	249.2287	267.3914	290.3185	311.8668	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	37.7111	(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)	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	(71)
Water heating gains (Table 5)	48.4919	46.9554	43.7647	39.4270	36.6108	32.6454	29.2749	33.5934	35.1278	39.6174	44.6870	46.9618	(72)
Total internal gains	470.9741	469.5711	453.0243	425.4199	395.6605	368.2949	351.3373	355.5223	370.4127	398.1691	430.1819	455.8569	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.7000	10.6334	0.6300	0.7000	0.7700	28.2724	(74)
East	3.0000	19.6403	0.6300	0.7000	0.7700	18.0070	(76)
South	13.9000	46.7521	0.6300	0.7000	0.7700	198.6037	(78)
West	11.1400	19.6403	0.6300	0.7000	0.7700	66.8658	(80)

Solar gains	311.7490	545.3210	779.5625	1014.5250	1175.3465	1182.5640	1133.6830	1012.2494	861.2041	612.1487	376.1172	264.9765	(83)
Total gains	782.7231	1014.8921	1232.5868	1439.9449	1571.0070	1550.8590	1485.0203	1367.7717	1231.6168	1010.3178	806.2991	720.8333	(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	54.1632	54.3020	54.4387	55.0903	55.2139	55.7969	55.7969	55.9062	55.5709	55.2139	54.9644	54.7059	
alpha	4.6109	4.6201	4.6292	4.6727	4.6809	4.7198	4.7198	4.7271	4.7047	4.6809	4.6643	4.6471	
util living area	0.9990	0.9966	0.9885	0.9593	0.8781	0.7212	0.5544	0.6167	0.8574	0.9805	0.9976	0.9993	(86)
MIT	19.4980	19.7082	20.0219	20.4145	20.7407	20.9294	20.9838	20.9738	20.8317	20.3826	19.8605	19.4660	(87)
Th 2	19.8549	19.8574	19.8600	19.8719	19.8741	19.8845	19.8845	19.8864	19.8805	19.8741	19.8696	19.8649	(88)
util rest of house	0.9987	0.9954	0.9843	0.9433	0.8306	0.6242	0.4231	0.4829	0.7842	0.9702	0.9966	0.9991	(89)
MIT 2	18.4874	18.6990	19.0123	19.4036	19.7010	19.8527	19.8805	19.8792	19.7877	19.3809	18.8610	18.4633	(90)
Living area fraction									fLA = Living area / (4) =			0.1586	(91)
MIT	18.6477	18.8590	19.1725	19.5640	19.8659	20.0235	20.0555	20.0528	19.9533	19.5398	19.0196	18.6223	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6477	18.8590	19.1725	19.5640	19.8659	20.0235	20.0555	20.0528	19.9533	19.5398	19.0196	18.6223	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9981	0.9939	0.9808	0.9378	0.8302	0.6374	0.4441	0.5042	0.7899	0.9660	0.9954	0.9987	(94)
Ext temp.	781.2713	1008.6792	1208.8701	1350.3349	1304.3112	988.5667	659.4776	689.5813	972.8377	975.9323	802.6145	719.9189	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	16.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	2857.4024	2772.8923	2510.9977	2088.0309	1595.3183	1048.4809	668.0353	704.7950	1136.1855	1746.5216	2339.2309	2843.7696	(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	1544.6416	1185.5512	968.7829	531.1412	216.5093	0.0000	0.0000	0.0000	0.0000	573.3184	1106.3638	1580.1449	(98)
Space heating per m2										(98) / (4) =		49.6134	(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	1817.2324	1430.5872	1466.3789	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8510	0.9140	0.8852	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1546.5412	1307.5178	1298.0978	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1940.1863	1860.2173	1725.6776	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	283.4245	411.2085	318.1194	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1012.7524 (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	70.8561	102.8021	79.5299	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												253.1881 (107)
Space cooling per m2												1.6300 (108)
Energy for space heating												49.6134 (99)
Energy for space cooling												1.6300 (108)
Total												51.2434 (109)
Target Fabric Energy Efficiency (TFEE)												58.9 (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	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			33.6500	1.3258	44.6117		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			82.6300	0.1200	9.9156	75.0000	6197.2500 (28a)					
External Walls	200.7300	41.4500	159.2800	0.1900	30.2632	60.0000	9556.8000 (29a)					
Garage Wall	6.8000		6.8000	0.1700	1.1560	9.0000	61.2000 (29a)					
Pitched Cold Roof	78.2800		78.2800	0.1000	7.8280	9.0000	704.5200 (30)					
Bay Roof	4.3500		4.3500	0.1000	0.4350	9.0000	39.1500 (30)					
Total net area of external elements Aum(A, m2)			372.7900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	105.6356			(33)					
Internal Wall - Masonry			72.6600			75.0000	5449.5000 (32c)					
Internal Wall - Timber			140.2000			9.0000	1261.8000 (32c)					
Internal Floor			72.7000			18.0000	1308.6000 (32d)					
Internal Ceiling			72.7000			18.0000	1308.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		25887.4200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							166.6608 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9779 (36)					
Total fabric heat loss						(33) + (36) =	127.6135 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.5203	Feb 67.2403	Mar 66.4203	Apr 65.6003	May 67.2403	Jun 65.6003	Jul 65.6003	Aug 65.6003	Sep 65.6003	Oct 65.6003	Nov 65.6003	Dec 66.4203 (38)
Heat transfer coeff	198.1338	194.8538	194.0338	193.2138	194.8538	193.2138	193.2138	193.2138	193.2138	193.2138	193.2138	194.0338 (39)
Average = Sum(39)m / 12 =												194.0338 (39)
HLP	Jan 1.2756	Feb 1.2545	Mar 1.2492	Apr 1.2439	May 1.2545	Jun 1.2439	Jul 1.2439	Aug 1.2439	Sep 1.2439	Oct 1.2439	Nov 1.2439	Dec 1.2492 (40)
HLP (average)												1.2492 (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	2.9422 (42)
Average daily hot water use (litres/day)	104.0778 (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	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856	(44)
Energy conte	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217	(45)
Energy content (annual)	Total = Sum(45)m = 1637.5490												(45)
Distribution loss (46)m = 0.15 x (45)m	25.4668	22.2734	22.9842	20.0382	19.2271	16.5915	15.3745	17.6425	17.8532	20.8061	22.7115	24.6633	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	178.5438	177.9831	199.6350	210.3722	225.3491	(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	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	178.5438	177.9831	199.6350	210.3722	225.3491	(64)
RHI water heating demand	Total per year (kWh/year) = Sum(64)m = 2354.9200												(64)
Heat gains from water heating, kWh/month	105.1934	93.3978	99.6902	91.5876	91.3620	83.9475	82.8221	87.8494	86.7441	94.8622	97.5135	103.4121	(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	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.7163	64.5860	52.5249	39.7647	29.7246	25.0947	27.1157	35.2461	47.3072	60.0674	70.1075	74.7373	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	486.9587	492.0118	479.2781	452.1697	417.9501	385.7885	364.3026	359.2495	371.9832	399.0916	433.3112	465.4728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	(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)	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	(71)
Water heating gains (Table 5)	141.3889	138.9848	133.9922	127.2050	122.7984	116.5938	111.3200	118.0771	120.4779	127.5030	135.4354	138.9948	(72)
Total internal gains	818.5040	813.0226	783.2352	736.5793	687.9131	644.9170	620.1783	630.0127	657.2083	704.1020	756.2941	796.6449	(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					9.3200	14.6401	0.6300	0.7000	0.7700		41.6995 (74)	
East					3.2100	27.3735	0.6300	0.7000	0.7700		26.8539 (76)	
South					9.2000	61.3950	0.6300	0.7000	0.7700		172.6205 (78)	
West					11.9200	27.3735	0.6300	0.7000	0.7700		99.7190 (80)	
South					5.7000	61.3950	0.6300	0.7000	0.7700		106.9497 (78)	

Solar gains	447.8426	644.1423	920.6386	1232.4819	1384.3622	1492.8751	1429.4803	1274.6023	1084.0570	772.0778	518.0440	369.2498 (83)
Total gains	1266.3465	1457.1648	1703.8739	1969.0612	2072.2753	2137.7921	2049.6587	1904.6150	1741.2653	1476.1798	1274.3382	1165.8948 (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	36.2934	36.9043	37.0603	37.2176	36.9043	37.2176	37.2176	37.2176	37.2176	37.2176	37.2176	37.0603	
alpha	3.4196	3.4603	3.4707	3.4812	3.4603	3.4812	3.4812	3.4812	3.4812	3.4812	3.4812	3.4707	
util living area	0.9720	0.9552	0.9096	0.8088	0.6555	0.4514	0.3074	0.3202	0.5784	0.8357	0.9470	0.9768	(86)
MIT	19.5032	19.7280	20.1273	20.5570	20.8395	20.9681	20.9939	20.9933	20.9244	20.5946	20.0150	19.5026	(87)
Th 2	19.8600	19.8767	19.8809	19.8850	19.8767	19.8850	19.8850	19.8850	19.8850	19.8850	19.8850	19.8809	(88)
util rest of house	0.9655	0.9452	0.8896	0.7688	0.5876	0.3619	0.2053	0.2108	0.4838	0.7889	0.9327	0.9713	(89)
MIT 2	17.9216	18.2531	18.8175	19.3970	19.7334	19.8666	19.8834	19.8834	19.8339	19.4633	18.6740	17.9350	(90)
Living area fraction	fLA = Living area / (4) =												0.1586 (91)
MIT	18.1725	18.4871	19.0253	19.5810	19.9089	20.0413	20.0596	20.0594	20.0069	19.6428	18.8867	18.1836	(92)
Temperature adjustment													0.0000
adjusted MIT	18.1725	18.4871	19.0253	19.5810	19.9089	20.0413	20.0596	20.0594	20.0069	19.6428	18.8867	18.1836	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9519	0.9286	0.8707	0.7565	0.5897	0.3748	0.2215	0.2282	0.4948	0.7770	0.9156	0.9592	(94)
Useful gains	1205.4072	1353.1230	1483.6116	1489.5747	1222.0634	801.2907	454.0106	434.5573	861.5483	1146.9585	1166.7587	1118.3147	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	2550.4689	2491.6111	2255.7033	1870.4968	1346.2225	819.4833	455.9056	436.5545	909.4378	1476.6868	2026.1769	2461.0539 (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												
Space heating	1000.7259	765.0640	574.4362	274.2639	92.3743	0.0000	0.0000	0.0000	0.0000	245.3179	618.7811	998.9979 (98)
RHI space heating demand												4569.9612 (98)
												4570 (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	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			33.6500	1.3258	44.6117		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			82.6300	0.1200	9.9156	75.0000	6197.2500 (28a)					
External Walls	200.7300	41.4500	159.2800	0.1900	30.2632	60.0000	9556.8000 (29a)					
Garage Wall	6.8000		6.8000	0.1700	1.1560	9.0000	61.2000 (29a)					
Pitched Cold Roof	78.2800		78.2800	0.1000	7.8280	9.0000	704.5200 (30)					
Bay Roof	4.3500		4.3500	0.1000	0.4350	9.0000	39.1500 (30)					
Total net area of external elements Aum(A, m2)			372.7900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		105.6356		(33)					
Internal Wall - Masonry			72.6600			75.0000	5449.5000 (32c)					
Internal Wall - Timber			140.2000			9.0000	1261.8000 (32c)					
Internal Floor			72.7000			18.0000	1308.6000 (32d)					
Internal Ceiling			72.7000			18.0000	1308.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		25887.4200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							166.6608 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9779 (36)					
Total fabric heat loss						(33) + (36) =	127.6135 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 74.6203	Feb 73.8003	Mar 72.9803	Apr 68.8803	May 68.0603	Jun 65.6003	Jul 65.6003	Aug 65.6003	Sep 65.6003	Oct 68.0603	Nov 69.7003	Dec 71.3403 (38)
Heat transfer coeff	202.2338	201.4138	200.5938	196.4938	195.6738	193.2138	193.2138	193.2138	193.2138	195.6738	197.3138	198.9538 (39)
Average = Sum(39)m / 12 =												196.7671 (39)
HLP	Jan 1.3020	Feb 1.2967	Mar 1.2914	Apr 1.2650	May 1.2597	Jun 1.2439	Jul 1.2439	Aug 1.2439	Sep 1.2439	Oct 1.2597	Nov 1.2703	Dec 1.2808 (40)
HLP (average)												1.2668 (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	2.9422 (42)
Average daily hot water use (litres/day)	104.0778 (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	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856	(44)
Energy conte	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217	(45)
Energy content (annual)	Total = Sum (45)m = 1637.5490												(45)
Distribution loss (46)m = 0.15 x (45)m	25.4668	22.2734	22.9842	20.0382	19.2271	16.5915	15.3745	17.6425	17.8532	20.8061	22.7115	24.6633	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	178.5438	177.9831	199.6350	210.3722	225.3491	(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	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	178.5438	177.9831	199.6350	210.3722	225.3491	(64)
Heat gains from water heating, kWh/month	105.1934	93.3978	99.6902	91.5876	91.3620	83.9475	82.8221	87.8494	86.7441	94.8622	97.5135	103.4121	(65)
Total per year (kWh/year) = Sum (64)m = 2354.9200 (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	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	(66)
(66)m	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.7163	64.5860	52.5249	39.7647	29.7246	25.0947	27.1157	35.2461	47.3072	60.0674	70.1075	74.7373	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	486.9587	492.0118	479.2781	452.1697	417.9501	385.7885	364.3026	359.2495	371.9832	399.0916	433.3112	465.4728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	(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)	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	(71)
Water heating gains (Table 5)	141.3889	138.9848	133.9922	127.2050	122.7984	116.5938	111.3200	118.0771	120.4779	127.5030	135.4354	138.9948	(72)
Total internal gains	818.5040	813.0226	783.2352	736.5793	687.9131	644.9170	620.1783	630.0127	657.2083	704.1020	756.2941	796.6449	(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				9.3200	10.6334	0.6300	0.7000	0.7700	30.2872 (74)				
East				3.2100	19.6403	0.6300	0.7000	0.7700	19.2674 (76)				
South				9.2000	46.7521	0.6300	0.7000	0.7700	131.4500 (78)				
West				11.9200	19.6403	0.6300	0.7000	0.7700	71.5477 (80)				
South				5.7000	46.7521	0.6300	0.7000	0.7700	81.4418 (78)				
Solar gains	333.9941	584.1959	835.0566	1086.6435	1258.8267	1266.5317	1214.1899	1084.1774	922.4732	655.7646	402.9483	283.8889	(83)
Total gains	1152.4981	1397.2185	1618.2918	1823.2228	1946.7398	1911.4487	1834.3682	1714.1901	1579.6815	1359.8666	1159.2424	1080.5339	(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	35.5576	35.7024	35.8483	36.5963	36.7497	37.2176	37.2176	37.2176	37.2176	36.7497	36.4442	36.1438
alpha	3.3705	3.3802	3.3899	3.4398	3.4500	3.4812	3.4812	3.4812	3.4812	3.4500	3.4296	3.4096
util living area	0.9823	0.9661	0.9342	0.8649	0.7484	0.5885	0.4458	0.4917	0.7069	0.9010	0.9692	0.9855 (86)
MIT	19.2235	19.5004	19.8920	20.3608	20.7101	20.9104	20.9740	20.9632	20.8263	20.3527	19.7091	19.1888 (87)
Th 2	19.8393	19.8434	19.8476	19.8683	19.8725	19.8850	19.8850	19.8850	19.8850	19.8725	19.8642	19.8559 (88)
util rest of house	0.9782	0.9585	0.9194	0.8347	0.6939	0.5044	0.3403	0.3835	0.6288	0.8718	0.9610	0.9822 (89)
MIT 2	17.5039	17.9050	18.4655	19.1278	19.5817	19.8180	19.8728	19.8662	19.7388	19.1364	18.2242	17.4640 (90)
Living area fraction	17.7767	18.1581	18.6918	19.3234	19.7607	19.9913	20.0475	20.0402	19.9113	fLA = Living area / (4) = 0.1586 (91)		
MIT	17.7767	18.1581	18.6918	19.3234	19.7607	19.9913	20.0475	20.0402	19.9113	19.3294	18.4597	17.7376 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7767	18.1581	18.6918	19.3234	19.7607	19.9913	20.0475	20.0402	19.9113	19.3294	18.4597	17.7376 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9675	0.9433	0.9003	0.8175	0.6879	0.5129	0.3562	0.3992	0.6308	0.8544	0.9468	0.9729	(94)
Useful gains	1115.0657	1317.9802	1456.9205	1490.5457	1339.0819	980.3455	653.4933	684.3242	996.5201	1161.8038	1097.5916	1051.2717	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fracti	2725.4391	2670.3626	2445.5908	2048.1365	1577.2745	1041.6664	666.1039	703.3365	1122.8258	1708.1052	2241.4324	2693.3604	(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	1198.1178	908.8010	735.5707	401.4654	177.2153	0.0000	0.0000	0.0000	0.0000	406.4482	823.5653	1221.7140	(98)
Space heating per m2												5872.8977	(98)
												37.8092	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													6482.2271	(211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
Space heating requirement	1198.1178	908.8010	735.5707	401.4654	177.2153	0.0000	0.0000	0.0000	0.0000	406.4482	823.5653	1221.7140	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	1322.4258	1003.0916	811.8881	443.1185	195.6019	0.0000	0.0000	0.0000	0.0000	448.6184	909.0125	1348.4702	(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	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	177.9831	199.6350	210.3722	225.3491	225.3491	(64)	
Efficiency of water heater	88.6824	88.4331	87.9443	86.8307	84.7416	79.9000	79.9000	79.9000	79.9000	86.7724	88.1968	88.7492	(216)	
Fuel for water heating, kWh/month	260.1488	230.1409	243.5125	221.7531	223.1586	212.2306	204.5357	223.4591	222.7573	230.0674	238.5258	253.9169	(219)	
Water heating fuel used												2764.2067	(219)	
Annual totals kWh/year														
Space heating fuel - main system												6482.2271	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)														
mechanical ventilation fans (SFP = 0.2681)													130.0468	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													205.0468	(231)
Electricity for lighting (calculated in Appendix L)													513.6771	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.02 * 1068 * 1.00) =										-871.5455		-1103.5697		
PV Unit 1 (0.80 * 0.34 * 853 * 1.00) =										-232.0241		-1103.5697	(233)	
Total delivered energy for all uses												8861.5880	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	6482.2271	3.4800	225.5815 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2764.2067	3.4800	96.1944 (247)
Mechanical ventilation fans	130.0468	13.1900	17.1532 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	513.6771	13.1900	67.7540 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1103.5697	13.1900	-145.5608 (252)
Total energy cost			391.0147 (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] =	0.8198 (257)
SAP value			88.5641
SAP rating (Section 12)			89 (258)
SAP band			B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	6482.2271	0.2160	1400.1610 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2764.2067	0.2160	597.0686 (264)
Space and water heating			1997.2297 (265)
Pumps and fans	205.0468	0.5190	106.4193 (267)

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Energy for lighting	513.6771	0.5190	266.5984 (268)
Energy saving/generation technologies			
PV Unit	-1103.5697	0.5190	-572.7527 (269)
Total kg/year			1797.4947 (272)
CO2 emissions per m2			11.5700 (273)
EI value			87.9766
EI rating			88 (274)
EI band			B

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

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8500 = 4.094$, stars = 4
Water heating environmental impact	$0.216 / 0.8500 = 0.2541$, 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	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross 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)			33.6500	1.3258	44.6117		(27)
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)
Ground Floor			82.6300	0.1200	9.9156	75.0000	6197.2500 (28a)
External Walls	200.7300	41.4500	159.2800	0.1900	30.2632	60.0000	9556.8000 (29a)
Garage Wall	6.8000		6.8000	0.1700	1.1560	9.0000	61.2000 (29a)
Pitched Cold Roof	78.2800		78.2800	0.1000	7.8280	9.0000	704.5200 (30)
Bay Roof	4.3500		4.3500	0.1000	0.4350	9.0000	39.1500 (30)
Total net area of external elements Aum(A, m ²)			372.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		105.6356		(33)
Internal Wall - Masonry			72.6600			75.0000	5449.5000 (32c)
Internal Wall - Timber			140.2000			9.0000	1261.8000 (32c)
Internal Floor			72.7000			18.0000	1308.6000 (32d)
Internal Ceiling			72.7000			18.0000	1308.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25887.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							166.6608 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9779 (36)
Total fabric heat loss						(33) + (36) =	127.6135 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.5203	Feb 67.2403	Mar 66.4203	Apr 65.6003	May 67.2403	Jun 65.6003	Jul 65.6003	Aug 65.6003	Sep 65.6003	Oct 65.6003	Nov 65.6003	Dec 66.4203 (38)
Heat transfer coeff	198.1338	194.8538	194.0338	193.2138	194.8538	193.2138	193.2138	193.2138	193.2138	193.2138	193.2138	194.0338 (39)
Average = Sum(39)m / 12 =												194.0338 (39)
HLP	Jan 1.2756	Feb 1.2545	Mar 1.2492	Apr 1.2439	May 1.2545	Jun 1.2439	Jul 1.2439	Aug 1.2439	Sep 1.2439	Oct 1.2439	Nov 1.2439	Dec 1.2492 (40)
HLP (average)												1.2492 (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	2.9422 (42)
Average daily hot water use (litres/day)	104.0778 (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	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856	(44)
Energy conte	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217	(45)
Energy content (annual)	Total = Sum (45)m =											1637.5490	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4668	22.2734	22.9842	20.0382	19.2271	16.5915	15.3745	17.6425	17.8532	20.8061	22.7115	24.6633	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.2150	(55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	178.5438	177.9831	199.6350	210.3722	225.3491	(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	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	178.5438	177.9831	199.6350	210.3722	225.3491	(64)
Heat gains from water heating, kWh/month	105.1934	93.3978	99.6902	91.5876	91.3620	83.9475	82.8221	87.8494	86.7441	94.8622	97.5135	103.4121	(65)
Total per year (kWh/year) = Sum (64)m =													2354.9200 (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	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.7163	64.5860	52.5249	39.7647	29.7246	25.0947	27.1157	35.2461	47.3072	60.0674	70.1075	74.7373	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	486.9587	492.0118	479.2781	452.1697	417.9501	385.7885	364.3026	359.2495	371.9832	399.0916	433.3112	465.4728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	(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)	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	(71)
Water heating gains (Table 5)	141.3889	138.9848	133.9922	127.2050	122.7984	116.5938	111.3200	118.0771	120.4779	127.5030	135.4354	138.9948	(72)
Total internal gains	818.5040	813.0226	783.2352	736.5793	687.9131	644.9170	620.1783	630.0127	657.2083	704.1020	756.2941	796.6449	(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					9.3200	14.6401		0.6300	0.7000	0.7700		41.6995 (74)	
East					3.2100	27.3735		0.6300	0.7000	0.7700		26.8539 (76)	
South					9.2000	61.3950		0.6300	0.7000	0.7700		172.6205 (78)	
West					11.9200	27.3735		0.6300	0.7000	0.7700		99.7190 (80)	
South					5.7000	61.3950		0.6300	0.7000	0.7700		106.9497 (78)	

Solar gains	447.8426	644.1423	920.6386	1232.4819	1384.3622	1492.8751	1429.4803	1274.6023	1084.0570	772.0778	518.0440	369.2498	(83)
Total gains	1266.3465	1457.1648	1703.8739	1969.0612	2072.2753	2137.7921	2049.6587	1904.6150	1741.2653	1476.1798	1274.3382	1165.8948	(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	36.2934	36.9043	37.0603	37.2176	36.9043	37.2176	37.2176	37.2176	37.2176	37.2176	37.2176	37.0603	
alpha	3.4196	3.4603	3.4707	3.4812	3.4603	3.4812	3.4812	3.4812	3.4812	3.4812	3.4812	3.4707	
util living area	0.9720	0.9552	0.9096	0.8088	0.6555	0.4514	0.3074	0.3202	0.5784	0.8357	0.9470	0.9768	(86)
MIT	19.5032	19.7280	20.1273	20.5570	20.8395	20.9681	20.9939	20.9933	20.9244	20.5946	20.0150	19.5026	(87)
Th 2	19.8600	19.8767	19.8809	19.8850	19.8767	19.8850	19.8850	19.8850	19.8850	19.8850	19.8850	19.8809	(88)
util rest of house	0.9655	0.9452	0.8896	0.7688	0.5876	0.3619	0.2053	0.2108	0.4838	0.7889	0.9327	0.9713	(89)
MIT 2	17.9216	18.2531	18.8175	19.3970	19.7334	19.8666	19.8834	19.8834	19.8339	19.4633	18.6740	17.9350	(90)
Living area fraction	18.1725	18.4871	19.0253	19.5810	19.9089	20.0413	20.0596	20.0594	20.0069	19.6428	18.8867	18.1836	(91)
MIT	18.1725	18.4871	19.0253	19.5810	19.9089	20.0413	20.0596	20.0594	20.0069	19.6428	18.8867	18.1836	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.1725	18.4871	19.0253	19.5810	19.9089	20.0413	20.0596	20.0594	20.0069	19.6428	18.8867	18.1836	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9519	0.9286	0.8707	0.7565	0.5897	0.3748	0.2215	0.2282	0.4948	0.7770	0.9156	0.9592	(94)
Useful gains	1205.4072	1353.1230	1483.6116	1489.5747	1222.0634	801.2907	454.0106	434.5573	861.5483	1146.9585	1166.7587	1118.3147	(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													

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

Month fraction	2550.4689	2491.6111	2255.7033	1870.4968	1346.2225	819.4833	455.9056	436.5545	909.4378	1476.6868	2026.1769	2461.0539 (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 requirement	1000.7259	765.0640	574.4362	274.2639	92.3743	0.0000	0.0000	0.0000	0.0000	245.3179	618.7811	998.9979 (98)
Space heating requirement per m2												4569.9612 (98)
												29.4210 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5044.1073 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1000.7259	765.0640	574.4362	274.2639	92.3743	0.0000	0.0000	0.0000	0.0000	245.3179	618.7811	998.9979 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1104.5539	844.4415	634.0356	302.7196	101.9584	0.0000	0.0000	0.0000	0.0000	270.7703	682.9813	1102.6467 (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	230.7062	203.5208	214.1554	192.5499	189.1081	169.5722	163.4240	177.9831	199.6350	210.3722	225.3491	225.3491 (64)
Efficiency of water heater	88.3826	88.1204	87.4207	85.8574	83.1216	79.9000	79.9000	79.9000	85.4649	87.6228	88.4206	79.9000 (216)
Fuel for water heating, kWh/month	261.0314	230.9577	244.9710	224.2670	227.5079	212.2306	204.5357	223.4591	222.7573	233.5871	240.0885	254.8605 (219)
Water heating fuel used												2780.2537 (219)
Annual totals kWh/year												
Space heating fuel - main system												5044.1073 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)												
mechanical ventilation fans (SFP = 0.2681)												130.0468 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												205.0468 (231)
Electricity for lighting (calculated in Appendix L)												513.6771 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.02 * 1246 * 1.00) =									-1016.7491			-1293.4660
PV Unit 1 (0.80 * 0.34 * 1017 * 1.00) =									-276.7169			-1293.4660 (233)
Total delivered energy for all uses												7249.6189 (238)

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

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	5044.1073	3.6300	183.1011 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2780.2537	3.6300	100.9232 (247)
Mechanical ventilation fans	130.0468	19.4400	25.2811 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	513.6771	19.4400	99.8588 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1293.4660	19.4400	-251.4498 (252)
Total energy cost			267.2944 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	5044.1073	0.2160	1089.5272 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2780.2537	0.2160	600.5348 (264)
Space and water heating			1690.0620 (265)
Pumps and fans	205.0468	0.5190	106.4193 (267)
Energy for lighting	513.6771	0.5190	266.5984 (268)
Energy saving/generation technologies			
PV Unit	-1293.4660	0.5190	-671.3089 (269)
Total kg/year			1391.7708 (272)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	5044.1073	1.2200	6153.8109 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2780.2537	1.2200	3391.9096 (264)
Space and water heating			9545.7205 (265)
Pumps and fans	205.0468	3.0700	629.4937 (267)
Energy for lighting	513.6771	3.0700	1576.9887 (268)
Energy saving/generation technologies			
PV Unit	-1293.4660	3.0700	-3970.9407 (269)
Primary energy kWh/year			7781.2622 (272)
Primary energy kWh/m2/year			50.0950 (273)

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 42	-281 kg (20.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£42	1.81 kg/m²	B 90
Total Savings	£42	1.81 kg/m²	B 90
Potential energy efficiency rating:			B 90
Potential environmental impact rating:			B 90

Fuel prices for cost data on this page from database revision number 495 TEST (29 Apr 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£140	£149	-£10
Mains gas	£379	£327	£52
Space heating	£318	£319	-£1
Water heating	£101	£58	£43
Lighting	£100	£100	£0
Generated (PV)	-£251	-£251	£0
Total cost of fuels	£268	£225	£42
Total cost of uses	£268	£226	£42
Delivered energy	47 kWh/m²	38 kWh/m²	9 kWh/m²
Carbon dioxide emissions	1.4 tonnes	1.1 tonnes	0.3 tonnes
CO2 emissions per m²	9 kg/m²	7 kg/m²	2 kg/m²
Primary energy	50 kWh/m²	40 kWh/m²	10 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Front Door			2.1000	1.6000	3.3600		(26)					
Windows (Uw = 1.40)			33.6500	1.3258	44.6117		(27)					
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)					
Ground Floor			82.6300	0.1200	9.9156	75.0000	6197.2500 (28a)					
External Walls	200.7300	41.4500	159.2800	0.1900	30.2632	60.0000	9556.8000 (29a)					
Garage Wall	6.8000		6.8000	0.1700	1.1560	9.0000	61.2000 (29a)					
Pitched Cold Roof	78.2800		78.2800	0.1000	7.8280	9.0000	704.5200 (30)					
Bay Roof	4.3500		4.3500	0.1000	0.4350	9.0000	39.1500 (30)					
Total net area of external elements Aum(A, m2)			372.7900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	105.6356			(33)					
Internal Wall - Masonry			72.6600			75.0000	5449.5000 (32c)					
Internal Wall - Timber			140.2000			9.0000	1261.8000 (32c)					
Internal Floor			72.7000			18.0000	1308.6000 (32d)					
Internal Ceiling			72.7000			18.0000	1308.6000 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		25887.4200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							166.6608 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9779 (36)					
Total fabric heat loss						(33) + (36) =	127.6135 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 74.6203	Feb 73.8003	Mar 72.9803	Apr 68.8803	May 68.0603	Jun 65.6003	Jul 65.6003	Aug 65.6003	Sep 65.6003	Oct 68.0603	Nov 69.7003	Dec 71.3403 (38)
Heat transfer coeff	202.2338	201.4138	200.5938	196.4938	195.6738	193.2138	193.2138	193.2138	193.2138	195.6738	197.3138	198.9538 (39)
Average = Sum(39)m / 12 =												196.7671 (39)
HLP	Jan 1.3020	Feb 1.2967	Mar 1.2914	Apr 1.2650	May 1.2597	Jun 1.2439	Jul 1.2439	Aug 1.2439	Sep 1.2439	Oct 1.2597	Nov 1.2703	Dec 1.2808 (40)
HLP (average)												1.2668 (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	2.9422 (42)
Average daily hot water use (litres/day)	104.0778 (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	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856	(44)
Energy content (annual)	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4668	22.2734	22.9842	20.0382	19.2271	16.5915	15.3745	17.6425	17.8532	20.8061	22.7115	24.6633	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												1.2150	(55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	26.3655	23.8140	26.3655	25.5150	26.3655	25.5150	26.3655	26.3655	25.5150	26.3655	25.5150	26.3655	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	219.4067	193.3148	201.4601	174.8613	165.0143	146.0305	139.0976	155.1479	161.6452	186.9398	199.4372	214.0496	(62)
Aperture area of solar collector													
Zero-loss collector efficiency													3.0000 (H1)
Collector heat loss coefficient													0.7000 (H2)
Collector 2nd order heat loss coefficient													1.8000 (H3)
Collector effective heat loss coefficient													0.0050 (H3a)
Collector performance ratio													1.8063 (H3b)
Annual solar radiation per m2													2.5804 (H4)
Overshading factor													1079.5246 (H5)
Solar energy available													0.8000 (H6)
Adjustment factor for showers													1813.6014 (H7)
Solar-to-load ratio													1.0000 (H7a)
Utilisation factor													1.1075 (H8)
Collector performance factor													0.5946 (H9)
Dedicated solar storage volume													0.8793 (H10)
Effective solar volume													75.0000 (H11)
Daily hot water demand													127.5000 (H13)
Volume ratio Veff/V													104.0778 (H14)
Solar storage volume factor													1.2250 (H15)
Solar input													1.0000 (H16)
Solar input	-27.4968	-45.8843	-78.1462	-104.7312	-129.3866	-127.2077	-125.5266	-109.6732	-85.8961	-58.6569	-32.6152	-948.2308	(H17)
Solar input (sum of months) = Sum(63)m =												-23.0101	(63)
Output from w/h	191.9099	147.4306	123.3140	70.1300	35.6277	18.8229	13.5710	45.4747	75.7491	128.2829	166.8221	191.0395	(64)
Heat gains from water heating, kWh/month	96.1538	85.2330	89.5340	77.4367	72.0870	65.1141	63.3609	69.1326	73.6738	84.7060	88.7655	94.3725	(65)
Total per year (kWh/year) = Sum(64)m =												1208.1743	(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													
(66)m	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.7163	64.5860	52.5249	39.7647	29.7246	25.0947	27.1157	35.2461	47.3072	60.0674	70.1075	74.7373	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	486.9587	492.0118	479.2781	452.1697	417.9501	385.7885	364.3026	359.2495	371.9832	399.0916	433.3112	465.4728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	(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)	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	(71)
Water heating gains (Table 5)	129.2389	126.8348	120.3414	107.5510	96.8911	90.4363	85.1625	92.9202	102.3247	113.8522	123.2854	126.8448	(72)
Total internal gains	806.3540	800.8726	769.5844	716.9253	662.0057	618.7595	594.0209	604.8558	639.0551	690.4512	744.1441	784.4949	(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					9.3200	10.6334		0.6300	0.7000	0.7700		30.2872 (74)	
East					3.2100	19.6403		0.6300	0.7000	0.7700		19.2674 (76)	
South					9.2000	46.7521		0.6300	0.7000	0.7700		131.4500 (78)	
West					11.9200	19.6403		0.6300	0.7000	0.7700		71.5477 (80)	
South					5.7000	46.7521		0.6300	0.7000	0.7700		81.4418 (78)	

Solar gains	333.9941	584.1959	835.0566	1086.6435	1258.8267	1266.5317	1214.1899	1084.1774	922.4732	655.7646	402.9483	283.8889 (83)	
Total gains	1140.3481	1385.0685	1604.6410	1803.5688	1920.8325	1885.2912	1808.2107	1689.0331	1561.5283	1346.2158	1147.0924	1068.3839 (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	35.5576	35.7024	35.8483	36.5963	36.7497	37.2176	37.2176	37.2176	37.2176	36.7497	36.4442	36.1438	
alpha	3.3705	3.3802	3.3899	3.4398	3.4500	3.4812	3.4812	3.4812	3.4812	3.4500	3.4296	3.4096	
util living area	0.9828	0.9669	0.9356	0.8680	0.7539	0.5947	0.4515	0.4979	0.7119	0.9033	0.9701	0.9860	(86)
MIT	19.2145	19.4919	19.8836	20.3517	20.7029	20.9074	20.9730	20.9617	20.8223	20.3454	19.7006	19.1797	(87)
Th 2	19.8393	19.8434	19.8476	19.8683	19.8725	19.8850	19.8850	19.8850	19.8850	19.8725	19.8642	19.8559	(88)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

util rest of house	0.9788	0.9595	0.9210	0.8382	0.6997	0.5103	0.3450	0.3887	0.6340	0.8746	0.9621	0.9827 (89)
MIT 2	17.4910	17.8930	18.4539	19.1161	19.5738	19.8155	19.8723	19.8654	19.7349	19.1269	18.2120	17.4508 (90)
Living area fraction									fLA = Living area / (4) =			0.1586 (91)
MIT	17.7644	18.1467	18.6807	19.3121	19.7529	19.9887	20.0469	20.0393	19.9074	19.3201	18.4481	17.7251 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7644	18.1467	18.6807	19.3121	19.7529	19.9887	20.0469	20.0393	19.9074	19.3201	18.4481	17.7251 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9684	0.9444	0.9020	0.8209	0.6933	0.5186	0.3610	0.4046	0.6357	0.8571	0.9481	0.9737	(94)
Useful gains	1104.2824	1308.0861	1447.3850	1480.5430	1331.6694	977.7320	652.8366	683.3422	992.7146	1153.7958	1087.5874	1040.2866	(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													
	2722.9540	2668.0644	2443.3761	2045.9084	1575.7399	1041.1749	665.9846	703.1572	1122.0720	1706.3037	2239.1461	2690.8669	(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													
	1204.2917	913.9054	741.0174	407.0631	181.5884	0.0000	0.0000	0.0000	0.0000	411.0659	829.1223	1228.0318	(98)
Space heating													5916.0860 (98)
Space heating per m2													(98) / (4) = 38.0872 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6529.8962 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1204.2917	913.9054	741.0174	407.0631	181.5884	0.0000	0.0000	0.0000	0.0000	411.0659	829.1223	1228.0318 (98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)	
Space heating fuel (main heating system)	1329.2403	1008.7256	817.9000	449.2970	200.4287	0.0000	0.0000	0.0000	0.0000	453.7151	915.1460	1355.4435 (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	191.9099	147.4306	123.3140	70.1300	35.6277	18.8229	13.5710	45.4747	75.7491	128.2829	166.8221	191.0395 (64)	
Efficiency of water heater (217)m	88.9625	88.9454	88.9015	88.8513	88.6527	79.9000	79.9000	79.9000	79.9000	87.8033	88.6123	88.9956 (217)	
Fuel for water heating, kWh/month	215.7201	165.7540	138.7086	78.9296	40.1879	23.5580	16.9850	56.9145	94.8049	146.1026	188.2606	214.6618 (219)	
Water heating fuel used												1380.5878 (219)	
Annual totals kWh/year													
Space heating fuel - main system												6529.8962 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)													
mechanical ventilation fans (SFP = 0.2681)													130.0468 (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													255.0468 (231)
Electricity for lighting (calculated in Appendix L)													513.6771 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.02 * 1068 * 1.00) =									-871.5455			-1103.5697	
PV Unit 1 (0.80 * 0.34 * 853 * 1.00) =									-232.0241			-1103.5697 (233)	
Total delivered energy for all uses												7575.6382 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6529.8962	3.4800	227.2404 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1380.5878	3.4800	48.0445 (247)
Mechanical ventilation fans	130.0468	13.1900	17.1532 (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	513.6771	13.1900	67.7540 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1103.5697	13.1900	-145.5608 (252)
Total energy cost			351.1187 (255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12): 0.4200 (256)
Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] =$ 0.7361 (257)
SAP value 89.7309
SAP rating (Section 12) 90 (258)
SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6529.8962	0.2160	1410.4576 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1380.5878	0.2160	298.2070 (264)
Space and water heating			1708.6645 (265)
Pumps and fans	255.0468	0.5190	132.3693 (267)
Energy for lighting	513.6771	0.5190	266.5984 (268)
Energy saving/generation technologies			
PV Unit	-1103.5697	0.5190	-572.7527 (269)
Total kg/year			1534.8796 (272)
CO2 emissions per m2			9.8800 (273)
EI value			89.7332
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	82.6300 (1b)	x 2.4800 (2b)	= 204.9224 (1b) - (3b)
First floor	72.7000 (1c)	x 2.6500 (2c)	= 192.6550 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	155.3300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 397.5774 (5)

2. Ventilation rate

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

3. Heat losses and heat loss parameter

Element	Gross 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)			33.6500	1.3258	44.6117		(27)
French Doors (Uw = 1.50)			5.7000	1.4151	8.0660		(27)
Ground Floor			82.6300	0.1200	9.9156	75.0000	6197.2500 (28a)
External Walls	200.7300	41.4500	159.2800	0.1900	30.2632	60.0000	9556.8000 (29a)
Garage Wall	6.8000		6.8000	0.1700	1.1560	9.0000	61.2000 (29a)
Pitched Cold Roof	78.2800		78.2800	0.1000	7.8280	9.0000	704.5200 (30)
Bay Roof	4.3500		4.3500	0.1000	0.4350	9.0000	39.1500 (30)
Total net area of external elements Aum(A, m ²)			372.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		105.6356		(33)
Internal Wall - Masonry			72.6600			75.0000	5449.5000 (32c)
Internal Wall - Timber			140.2000			9.0000	1261.8000 (32c)
Internal Floor			72.7000			18.0000	1308.6000 (32d)
Internal Ceiling			72.7000			18.0000	1308.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25887.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							166.6608 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							21.9779 (36)
Total fabric heat loss						(33) + (36) =	127.6135 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 70.5203	Feb 67.2403	Mar 66.4203	Apr 65.6003	May 67.2403	Jun 65.6003	Jul 65.6003	Aug 65.6003	Sep 65.6003	Oct 65.6003	Nov 65.6003	Dec 66.4203 (38)
Heat transfer coeff	198.1338	194.8538	194.0338	193.2138	194.8538	193.2138	193.2138	193.2138	193.2138	193.2138	193.2138	194.0338 (39)
Average = Sum(39)m / 12 =												194.0338 (39)
HLP	Jan 1.2756	Feb 1.2545	Mar 1.2492	Apr 1.2439	May 1.2545	Jun 1.2439	Jul 1.2439	Aug 1.2439	Sep 1.2439	Oct 1.2439	Nov 1.2439	Dec 1.2492 (40)
HLP (average)												1.2492 (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	2.9422 (42)
Average daily hot water use (litres/day)	104.0778 (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	114.4856	110.3225	106.1594	101.9962	97.8331	93.6700	93.6700	97.8331	101.9962	106.1594	110.3225	114.4856	(44)
Energy conte	169.7788	148.4896	153.2280	133.5879	128.1807	110.6102	102.4966	117.6164	119.0211	138.7076	151.4102	164.4217	(45)
Energy content (annual)	Total = Sum (45)m =											1637.5490	(45)
Distribution loss (46)m = 0.15 x (45)m	25.4668	22.2734	22.9842	20.0382	19.2271	16.5915	15.3745	17.6425	17.8532	20.8061	22.7115	24.6633	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.2500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650	(56)
If cylinder contains dedicated solar storage	26.3655	23.8140	26.3655	25.5150	26.3655	25.5150	26.3655	26.3655	25.5150	26.3655	25.5150	26.3655	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	219.4067	193.3148	201.4601	174.8613	165.0143	146.0305	139.0976	155.1479	161.6452	186.9398	199.4372	214.0496	(62)
Aperture area of solar collector													3.0000 (H1)
Zero-loss collector efficiency													0.7000 (H2)
Collector heat loss coefficient													1.8000 (H3)
Collector 2nd order heat loss coefficient													0.0050 (H3a)
Collector effective heat loss coefficient													1.8063 (H3b)
Collector performance ratio													2.5804 (H4)
Annual solar radiation per m2													1269.6808 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													2133.0637 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.3026 (H8)
Utilisation factor													0.5359 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													127.5000 (H13)
Daily hot water demand													104.0778 (H14)
Volume ratio Veff/V													1.2250 (H15)
Solar storage volume factor													1.0000 (H16)
Solar input													-1005.1654 (H17)
Solar input	-33.8532	-46.4573	-78.9290	-108.2567	-129.0758	-135.7514	-133.9092	-117.2659	-92.3037	-63.3833	-38.5066	-27.4735	(63)
Solar input (sum of months) = Sum(63)m =													-1005.1654 (63)
Output from w/h	185.5535	146.8576	122.5312	66.6046	35.9386	10.2791	5.1884	37.8820	69.3415	123.5565	160.9307	186.5761	(64)
Total per year (kWh/year) = Sum(64)m =													1151.2397 (64)
Heat gains from water heating, kWh/month	96.1538	85.2330	89.5340	77.4367	72.0870	65.1141	63.3609	69.1326	73.6738	84.7060	88.7655	94.3725	(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	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	176.5334	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	72.7163	64.5860	52.5249	39.7647	29.7246	25.0947	27.1157	35.2461	47.3072	60.0674	70.1075	74.7373	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	486.9587	492.0118	479.2781	452.1697	417.9501	385.7885	364.3026	359.2495	371.9832	399.0916	433.3112	465.4728	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	55.5956	(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)	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	-117.6889	(71)
Water heating gains (Table 5)	129.2389	126.8348	120.3414	107.5510	96.8911	90.4363	85.1625	92.9202	102.3247	113.8522	123.2854	126.8448	(72)
Total internal gains	806.3540	800.8726	769.5844	716.9253	662.0057	618.7595	594.0209	604.8558	639.0551	690.4512	744.1441	784.4949	(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					9.3200	14.6401		0.6300	0.7000	0.7700		41.6995 (74)	
East					3.2100	27.3735		0.6300	0.7000	0.7700		26.8539 (76)	
South					9.2000	61.3950		0.6300	0.7000	0.7700		172.6205 (78)	
West					11.9200	27.3735		0.6300	0.7000	0.7700		99.7190 (80)	
South					5.7000	61.3950		0.6300	0.7000	0.7700		106.9497 (78)	
Solar gains	447.8426	644.1423	920.6386	1232.4819	1384.3622	1492.8751	1429.4803	1274.6023	1084.0570	772.0778	518.0440	369.2498	(83)
Total gains	1254.1965	1445.0148	1690.2231	1949.4072	2046.3679	2111.6347	2023.5012	1879.4581	1723.1121	1462.5290	1262.1882	1153.7448	(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	36.2934	36.9043	37.0603	37.2176	36.9043	37.2176	37.2176	37.2176	37.2176	37.2176	37.2176	37.2176	
alpha	3.4196	3.4603	3.4707	3.4812	3.4603	3.4812	3.4812	3.4812	3.4812	3.4812	3.4812	3.4707	
util living area	0.9728	0.9562	0.9113	0.8124	0.6611	0.4563	0.3112	0.3243	0.5830	0.8388	0.9484	0.9775	(86)
MIT	19.4946	19.7199	20.1197	20.5499	20.8351	20.9670	20.9937	20.9930	20.9224	20.5890	20.0071	19.4937	(87)
Th 2	19.8600	19.8767	19.8809	19.8850	19.8767	19.8850	19.8850	19.8850	19.8850	19.8850	19.8850	19.8809	(88)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

util rest of house	0.9664	0.9464	0.8916	0.7728	0.5933	0.3661	0.2079	0.2136	0.4882	0.7924	0.9343	0.9721 (89)
MIT 2	17.9092	18.2417	18.8073	19.3882	19.7291	19.8659	19.8834	19.8833	19.8325	19.4567	18.6631	17.9223 (90)
Living area fraction									fLA = Living area / (4) =			0.1586 (91)
MIT	18.1607	18.4762	19.0155	19.5725	19.9045	20.0406	20.0595	20.0593	20.0054	19.6363	18.8763	18.1715 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1607	18.4762	19.0155	19.5725	19.9045	20.0406	20.0595	20.0593	20.0054	19.6363	18.8763	18.1715 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9530	0.9299	0.8727	0.7602	0.5951	0.3791	0.2243	0.2312	0.4991	0.7802	0.9173	0.9602	(94)	
Useful gains	1195.2202	1343.7654	1475.1149	1481.8940	1217.7439	800.4942	453.9130	434.4509	859.9677	1141.1297	1157.8369	1107.8728	(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														
	2548.1371	2489.4835	2253.7905	1868.8601	1345.3762	819.3390	455.8871	436.5342	909.1428	1475.4349	2024.1615	2458.7067	(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														
	1006.5702	769.9226	579.3347	278.6156	94.9584	0.0000	0.0000	0.0000	0.0000	248.7230	623.7537	1005.0205	(98)	
Space heating													4606.8986	(98)
Space heating per m2													29.6588	(99)
											(98) / (4) =			

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5084.8771 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1006.5702	769.9226	579.3347	278.6156	94.9584	0.0000	0.0000	0.0000	0.0000	248.7230	623.7537	1005.0205 (98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)	
Space heating fuel (main heating system)	1111.0046	849.8041	639.4422	307.5227	104.8106	0.0000	0.0000	0.0000	0.0000	274.5287	688.4699	1109.2941 (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	185.5535	146.8576	122.5312	66.6046	35.9386	10.2791	5.1884	37.8820	69.3415	123.5565	160.9307	186.5761 (64)	
Efficiency of water heater (217)m	88.7501	88.6973	88.5302	88.3181	87.3870	79.9000	79.9000	79.9000	79.9000	86.7445	88.1782	88.7393 (217)	
Fuel for water heating, kWh/month	209.0742	165.5717	138.4060	75.4144	41.1258	12.8649	6.4936	47.4117	86.7854	142.4372	182.5062	210.2520 (219)	
Water heating fuel used												1318.3432 (219)	
Annual totals kWh/year													
Space heating fuel - main system												5084.8771 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)													
mechanical ventilation fans (SFP = 0.2681)													130.0468 (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													255.0468 (231)
Electricity for lighting (calculated in Appendix L)													513.6771 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.02 * 1246 * 1.00) =									-1016.7491			-1293.4660	
PV Unit 1 (0.80 * 0.34 * 1017 * 1.00) =									-276.7169			-1293.4660 (233)	
Total delivered energy for all uses												5878.4782 (238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5084.8771	3.6300	184.5810 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1318.3432	3.6300	47.8559 (247)	
Mechanical ventilation fans	130.0468	19.4400	25.2811 (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	513.6771	19.4400	99.8588 (250)	
Additional standing charges			95.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1293.4660	19.4400	-251.4498 (252)	
Total energy cost			225.4270 (255)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5084.8771	0.2160	1098.3334 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1318.3432	0.2160	284.7621 (264)
Space and water heating			1383.0956 (265)
Pumps and fans	255.0468	0.5190	132.3693 (267)
Energy for lighting	513.6771	0.5190	266.5984 (268)
Energy saving/generation technologies			
PV Unit	-1293.4660	0.5190	-671.3089 (269)
Total kg/year			1110.7544 (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	5084.8771	1.2200	6203.5500 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1318.3432	1.2200	1608.3787 (264)
Space and water heating			7811.9287 (265)
Pumps and fans	255.0468	3.0700	782.9937 (267)
Energy for lighting	513.6771	3.0700	1576.9887 (268)
Energy saving/generation technologies			
PV Unit	-1293.4660	3.0700	-3970.9407 (269)
Primary energy kWh/year			6200.9704 (272)
Primary energy kWh/m2/year			39.9213 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	166.7 (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	1049.60 (P1)
Transmission heat loss coefficient	127.61 (37)
Summer heat loss coefficient	1177.22 (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	9.3200	87.1704	0.6300	0.7000	0.9000	290.2076
East	3.2100	125.2818	0.6300	0.7000	0.9000	143.6536
South	9.2000	118.5567	0.6300	0.7000	0.9000	389.6166
West	11.9200	125.2818	0.6300	0.7000	0.9000	533.4427
South	5.7000	118.5567	0.6300	0.7000	0.9000	241.3929
total:						1598.3134

Solar gains	Jun 1710	Jul 1598	Aug 1452	(P3)
Internal gains	642	617	627	
Total summer gains	2352	2215	2079	(P5)
Summer gain/loss ratio	2.00	1.88	1.77	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 166.7)	0.83	0.83	0.83	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Threshold temperature	18.23	20.02	19.90	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			

PREDICTED ENERGY ASSESSMENT

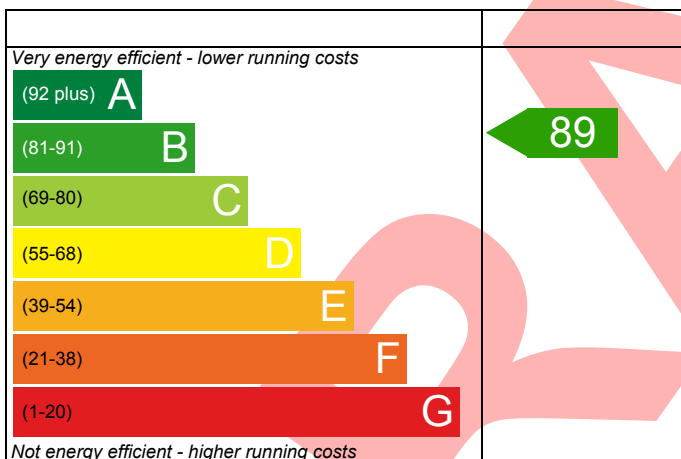
Plot 2, Long Copse Lane,
Emsworth,
Hampshire,
PO10 7UR

Dwelling type: House, Detached
Date of assessment: 10/05/2022
Produced by: Scott Spearing
Total floor area: 155.33 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

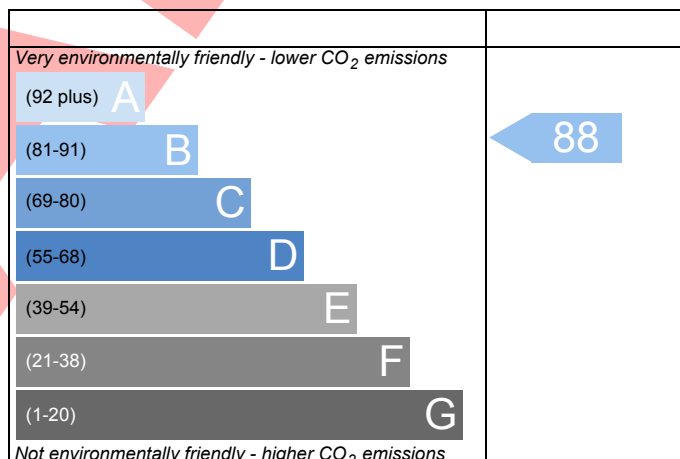


England

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.