



SAP Report Submission for Building Regulations Compliance

Client: Metis Build Ltd

Project: Plot 5, 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 5			Issued on Date	10/05/2022
Assessment Reference	Rev A	Prop Type Ref			
Property	Plot 5, Long Copse Lane, Emsworth, Hampshire, PO10 7UR				
SAP Rating	89 B	DER	12.03	TER	15.09
Environmental	88 B	% DER<TER	20.28		
CO ₂ Emissions (t/year)	1.47	DFEE	48.74	TFEE	55.87
General Requirements Compliance	Pass	% DFEE<TFEE	12.76		
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)	15.09	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	12.03	kgCO ₂ /m ²	Pass
	-3.06 (-20.3%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.87	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	48.74	kWh/m ² /yr	
	-7.2 (-12.9%)	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	1.43 (max. 2.00)	1.60 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

Limiting System Efficiencies

4 Heating efficiency

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

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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

11.43 m², No overhang

Windows facing East

2.07 m², No overhang

Windows facing South

14.05 m², No overhang

Windows facing West

7.16 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:	42.21 m	90.25 m ²	2.48 m
	1st Storey:	38.53 m	85.58 m ²	2.65 m

7.0 Living Area	20.71	m ²
8.0 Thermal Mass Parameter	Precise calculation	
Thermal Mass	184.45	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	206.79	169.98

9.2 Internal Walls				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Internal Wall - Masonry	Dense block, plasterboard on dabs		75.00	94.99
Internal Wall - Timber	Plasterboard on timber frame		9.00	143.16

10.0 External Roofs						
Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Pitched Cold Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	85.58	85.58
Bay Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	4.67	4.67

10.2 Internal Ceilings				
Description	Construction		Kappa (kJ/m ² K)	Area (m ²)
Internal Ceiling	Plasterboard ceiling, carpeted chipboard floor		9.00	85.58

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Kappa (kJ/m²K)	Area (m²)
Ground Floor	Ground Floor - Solid	Slab on ground, screed over insulation	0.12	110.00	90.25

11.2 Internal Floors

Description	Construction	Kappa (kJ/m²K)	Area (m²)
Internal Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	85.58

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	Manufacture r	Solid Door							1.60
Side Door	Manufacture r	Half Glazed Door	Double Low-E Soft 0.05			0.63		0.70	1.50
Windows	Manufacture r	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
French Doors	Manufacture r	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					11.43	
Side Elevation	Window	[1] External Walls	West	None	0.00					5.21	
Side Door	Window	[1] External Walls	West	None	0.00					1.95	
Rear French Doors	Window	[1] External Walls	South	None	0.00					6.30	
Rear Elevation	Window	[1] External Walls	South	None	0.00					7.75	
Side Elevation	Window	[1] External Walls	East	None	0.00					2.07	

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)	25.27	0.050	Yes	Hi-Therms
Table K1 - Approved	E3 Sill	24.27	0.040	Yes	
Table K1 - Approved	E4 Jamb	51.00	0.050	No	
Table K1 - Approved	E5 Ground floor (normal)	42.21	0.160	Yes	
Table K1 - Approved	E6 Intermediate floor within a dwelling	38.53	0.070	Yes	
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	42.66	0.060	No	
Table K1 - Approved	E12 Gable (insulation at ceiling level)	4.60	0.240	No	
Table K1 - Approved	E16 Corner (normal)	33.05	0.090	No	
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	12.50	-0.090	No	

Y-value 0.051 W/m²K

18.0 Pressure Testing

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

19.0 Mechanical Ventilation

Summer Overheating

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

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	
PCDF Controls	CBI Time and temperature zone control	
Delayed Start Stat	0	
	No	

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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
1.36	South	45°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

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

U-VALUE CALCULATOR REPORT

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Client	Metis Build Ltd, METIS BUILD		

Building Elements

Roof Pitched Cold Roof

Roof Type: Pitched Roof, insulated flat ceiling

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.0400	
Layer 1	Mineral wool				
	Main construction	200	0.0400	5.0000	100.00
	Corrections - Air Gap: Level 0, Fasteners: None or plastic				
Layer 2	Mineral wool				
	Main construction	200	0.0400	5.0000	91.67
	Main construction	200	0.1300	1.5385	8.33
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Plasterboard, standard				
	Main construction	12.5	0.2100	0.0595	100.00
Layer 4	Plaster, standard				
	Main construction	3	0.4000	0.0075	100.00
Int surface				0.1000	

Total resistance:	Upper limit = 9.788 m ² K/W	Lower limit = 9.418 m ² K/W	Average = 9.603 m ² K/W
	Total correction = 0.0019 m ² K/W	U-value (unrounded) = 0.1 W/m ² K	

Unheated space: None

Total thickness: 416 mm

U-value: 0.10 W/m² K

Kappa: n/a

U-VALUE CALCULATOR REPORT

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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

U-VALUE CALCULATOR REPORT

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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 = 90.25 m², Perimeter = 42.21 m, Wall thickness = 320.00 mm, Soil: Unknown

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

Floor height above ground: h = 0.200 m

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

Ventilation openings per perimeter length: e = 0.0015 %

Mean wind speed: v = 5.000 m/s

Resistance on solum: R_g = 0.000 m²K/W

Layer	Description	Thickness (mm)	Conductivity (W/m ² K)	Resistance (m ² K/W)	Fraction (%)
Ext surface				0.1700	
Layer 1	Concrete, reinforced (1% steel)				
	Main construction	300	2.3000	0.1304	100.00
Layer 2	Celotex XR4000				
	Main construction	150	0.0220	6.8182	100.00
	Corrections - Air Gap: Level 1, Fasteners: None or plastic				
Layer 3	Screed				
	Main construction	75	1.1500	0.0652	100.00
Int surface				0.1700	

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

Total correction = 0.0086 m² K/W

U-value (unrounded) = 0.12 W/m² K

Unheated space: None

Total thickness: 525 mm

U-value: 0.12 W/m² K

Kappa: n/a

FULL SAP CALCULATION PRINTOUT

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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 176 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 15.09 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.03 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)48.7 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Data from database

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

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 2.25 kWh/day

Permitted by DBSCG 2.56	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power:	0.2000 0.1800	
Maximum	0.7	OK

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading:	Average
Windows facing North:	11.43 m ² , No overhang
Windows facing East:	2.07 m ² , No overhang
Windows facing South:	14.05 m ² , No overhang
Windows facing West:	7.16 m ² , No overhang
Air change rate:	8.00 ach
Blinds/curtains:	None

10 Key features

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3188	0.3125	0.3063	0.2750	0.2688	0.2375	0.2375	0.2313	0.2500	0.2688	0.2813	0.2938 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5688	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5313	0.5438 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1000	1.6000	3.3600		(26)
Windows (Uw = 1.40)			28.4100	1.3258	37.6648		(27)
French Doors (Uw = 1.50)			6.3000	1.4151	8.9151		(27)
Ground Floor			90.2500	0.1200	10.8300	110.0000	9927.5000 (28a)
External Walls	206.7900	36.8100	169.9800	0.1900	32.2962	60.0000	10198.8000 (29a)
Pitched Cold Roof	85.5800		85.5800	0.1000	8.5580	9.0000	770.2200 (30)
Bay Roof	4.6700		4.6700	0.1000	0.4670	9.0000	42.0300 (30)
Total net area of external elements Aum(A, m ²)			387.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.0911		(33)
Internal Wall - Masonry			94.9900			75.0000	7124.2500 (32c)
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)
Internal Floor			85.5800			18.0000	1540.4400 (32d)
Internal Ceiling			85.5800			18.0000	1540.4400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 32432.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 184.4516 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 19.7481 (36)
Total fabric heat loss (33) + (36) = 121.8392 (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	84.5733	83.6439	82.7145	78.0677	77.1383	74.3502	74.3502	74.3502	74.3502	77.1383	78.9970	80.8558 (38)
Heat transfer coeff	206.4125	205.4831	204.5537	199.9068	198.9775	196.1893	196.1893	196.1893	196.1893	198.9775	200.8362	202.6950 (39)
Average = Sum(39)m / 12 =												200.2166 (39)
HLP	1.1739	1.1686	1.1634	1.1369	1.1316	1.1158	1.1158	1.1158	1.1158	1.1316	1.1422	1.1528 (40)
HLP (average)												1.1387 (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												2.9703 (42)
Average daily hot water use (litres/day)												104.7452 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Daily hot water use	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy conte	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)
Energy content (annual)												1648.0491 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6301	22.4163	23.1316	20.1667	19.3504	16.6979	15.4731	17.7556	17.9676	20.9396	22.8572	24.8214 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												
Primary loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Total heat required for water heating calculated for each month	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Solar input	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (62)
Solar input (sum of months) = Sum(63)m =	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (64)
Heat gains from water heating, kWh/month	105.5553	93.7143	100.0169	91.8724	91.6353	84.1833	83.0406	88.1001	86.9979	95.1579	97.8363	103.7627 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2378	27.7451	22.5638	17.0823	12.7692	10.7803	11.6485	15.1412	20.3224	25.8040	30.1171	32.1060 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.4497	351.0551	341.9695	322.6274	298.2114	275.2638	259.9334	256.3279	265.4135	284.7557	309.1717	332.1193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129 (71)
Water heating gains (Table 5)	141.8755	139.4559	134.4313	127.6005	123.1657	116.9213	111.6137	118.4142	120.8304	127.9005	135.8838	139.4660 (72)
Total internal gains	591.1177	588.8109	569.5195	537.8650	504.7011	473.5202	453.7504	460.4381	477.1212	509.0150	545.7273	574.2460 (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					11.4300	10.6334	0.6300	0.7000			0.7700	37.1441 (74)	
East					2.0700	19.6403	0.6300	0.7000			0.7700	12.4248 (76)	
South					7.7500	46.7521	0.6300	0.7000			0.7700	110.7323 (78)	
West					7.1600	19.6403	0.6300	0.7000			0.7700	42.9766 (80)	
South					6.3000	46.7521	0.6300	0.7000			0.7700	90.0146 (78)	
Solar gains	293.2925	508.1330	717.8979	927.3819	1073.2471	1080.6449	1035.5498	924.4218	790.0879	567.7071	352.8547	249.9884	(83)
Total gains	884.4102	1096.9439	1287.4174	1465.2469	1577.9483	1554.1651	1489.3002	1384.8599	1267.2091	1076.7220	898.5820	824.2345	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.6452	43.8426	44.0418	45.0656	45.2761	45.9195	45.9195	45.9195	45.9195	45.2761	44.8571	44.4457
alpha	3.9097	3.9228	3.9361	4.0044	4.0184	4.0613	4.0613	4.0613	4.0613	4.0184	3.9905	3.9630
util living area	0.9964	0.9912	0.9785	0.9423	0.8590	0.7091	0.5512	0.6066	0.8280	0.9639	0.9926	0.9973 (86)
MIT	19.2806	19.5099	19.8538	20.2984	20.6650	20.8957	20.9713	20.9576	20.7932	20.3020	19.7177	19.2605 (87)
Th 2	19.9409	19.9452	19.9494	19.9708	19.9751	19.9880	19.9880	19.9880	19.9880	19.9751	19.9665	19.9580 (88)
util rest of house	0.9954	0.9889	0.9726	0.9258	0.8174	0.6271	0.4368	0.4918	0.7636	0.9504	0.9903	0.9965 (89)
MIT 2	17.6363	17.9732	18.4746	19.1228	19.6215	19.9060	19.9739	19.9652	19.8015	19.1405	18.2916	17.6179 (90)
Living area fraction									fLA = Living area / (4) =			0.1178 (91)
MIT	17.8300	18.1542	18.6371	19.2613	19.7444	20.0226	20.0914	20.0821	19.9183	19.2773	18.4596	17.8114 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8300	18.1542	18.6371	19.2613	19.7444	20.0226	20.0914	20.0821	19.9183	19.2773	18.4596	17.8114 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9923	0.9829	0.9622	0.9111	0.8064	0.6302	0.4491	0.5032	0.7584	0.9377	0.9851	0.9941 (94)
Ext temp.	877.6431	1078.2375	1238.7771	1335.0105	1272.4789	979.4678	668.8710	696.8510	961.0981	1009.6945	885.2293	819.4082 (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)
	2792.7530	2723.5078	2482.6821	2071.2950	1600.6602	1063.8543	684.9704	722.3824	1141.4888	1726.5896	2281.4117	2758.9655 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1424.8418	1105.6216	925.4654	530.1248	244.1669	0.0000	0.0000	0.0000	0.0000	533.3700	1005.2513	1443.0306 (98)
Space heating												7211.8724 (98)
Space heating per m2											(98) / (4) =	41.0162 (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												7960.1240 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1424.8418	1105.6216	925.4654	530.1248	244.1669	0.0000	0.0000	0.0000	0.0000	533.3700	1005.2513	1443.0306 (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)	1572.6731	1220.3329	1021.4849	585.1267	269.4999	0.0000	0.0000	0.0000	0.0000	588.7086	1109.5489	1592.7490 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (64)
Efficiency of water heater (217)m	88.9336	88.7451	88.3679	87.4688	85.5853	79.9000	79.9000	79.9000	79.9000	87.4019	88.5402	79.9000 (216)
Fuel for water heating, kWh/month	260.6381	230.4047	243.4571	221.1147	221.9190	213.1183	205.3583	224.4030	223.7125	229.4280	238.6973	254.4318 (219)
Water heating fuel used												2766.6826 (219)
Annual totals kWh/year												
Space heating fuel - main system												7960.1240 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)												
mechanical ventilation fans (SFP = 0.2681)												147.3927 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												222.3927 (231)
Electricity for lighting (calculated in Appendix L)												551.6687 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.36 * 1068 * 1.00) =									-1162.0607			-1162.0607 (233)
Total delivered energy for all uses												10338.8073 (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	7960.1240	0.2160	1719.3868 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2766.6826	0.2160	597.6034 (264)
Space and water heating			2316.9902 (265)
Pumps and fans	222.3927	0.5190	115.4218 (267)
Energy for lighting	551.6687	0.5190	286.3161 (268)
Energy saving/generation technologies			
PV Unit	-1162.0607	0.5190	-603.1095 (269)
Total CO2, kg/year			2115.6186 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.0300 (273)

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

DER			12.0300 ZC1
Total Floor Area		TFA	175.8300
Assumed number of occupants		N	2.9703
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			11.7097 ZC2
CO2 emissions from cooking, equation (L16)			1.0822 ZC3
Total CO2 emissions			24.8219 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			24.8219 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	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0888 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3388 (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) =	0.3388 (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	0.4319	0.4235	0.4150	0.3726	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981 (22b)
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792 (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)			34.7100	1.3258	46.0170		(27)
Ground Floor			90.2500	0.1300	11.7325		(28a)
External Walls	206.7900	36.8100	169.9800	0.1800	30.5964		(29a)
Pitched Cold Roof	85.5800		85.5800	0.1300	11.1254		(30)
Bay Roof	4.6700		4.6700	0.1300	0.6071		(30)
Total net area of external elements Aum(A, m ²)			387.2900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	102.1784	(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)							16.4657 (36)
Total fabric heat loss						(33) + (36) =	118.6441 (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	88.2212	87.6826	87.1546	84.6748	84.2108	82.0510	82.0510	81.6510	82.8829	84.2108	85.1494	86.1307 (38)
Heat transfer coeff	206.8654	206.3267	205.7988	203.3189	202.8550	200.6951	200.6951	200.2951	201.5271	202.8550	203.7936	204.7748 (39)
Average = Sum(39)m / 12 =												203.3167 (39)
HLP	1.1765	1.1734	1.1704	1.1563	1.1537	1.1414	1.1414	1.1391	1.1461	1.1537	1.1590	1.1646 (40)
HLP (average)												1.1563 (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												2.9703 (42)
Average daily hot water use (litres/day)												104.7452 (43)
Daily hot water use	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy conte	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)
Energy content (annual)										Total = Sum(45)m =		1648.0491 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6301	22.4163	23.1316	20.1667	19.3504	16.6979	15.4731	17.7556	17.9676	20.9396	22.8572	24.8214 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444 28.5820 31.6444 30.6236 31.6444 30.6236 31.6444 31.6444 30.6236 31.6444 30.6236 31.6444 (56)												
If cylinder contains dedicated 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 23.2624 22.5120 23.2624 22.5120 23.2624 (59)												
Total heat required for water heating calculated for each month												
225.7742 199.0350 209.1173 187.5801 183.9094 164.4551 158.0607 173.2774 172.9199 194.5038 205.5167 220.3828 (62)												
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)												
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h												
225.7742 199.0350 209.1173 187.5801 183.9094 164.4551 158.0607 173.2774 172.9199 194.5038 205.5167 220.3828 (64)												
Heat gains from water heating, kWh/month												
100.7389 89.3640 95.2004 87.2113 86.8188 79.5222 78.2241 83.2836 82.3368 90.3414 93.1752 98.9462 (65)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m 148.5161 148.5161 148.5161 148.5161 148.5161 148.5161 148.5161 148.5161 148.5161 148.5161 148.5161 148.5161 (66)													
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2378 27.7451 22.5638 17.0823 12.7692 10.7803 11.6485 15.1412 20.3224 25.8040 30.1171 32.1060 (67)												
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.4497 351.0551 341.9695 322.6274 298.2114 275.2638 259.9334 256.3279 265.4135 284.7557 309.1717 332.1193 (68)												
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8516 37.8516 37.8516 37.8516 37.8516 37.8516 37.8516 37.8516 37.8516 37.8516 37.8516 37.8516 (69)												
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)													
Losses e.g. evaporation (negative values) (Table 5)	-118.8129 -118.8129 -118.8129 -118.8129 -118.8129 -118.8129 -118.8129 -118.8129 -118.8129 -118.8129 -118.8129 -118.8129 (71)												
Water heating gains (Table 5)	135.4017 132.9821 127.9576 121.1268 116.6920 110.4475 105.1399 111.9404 114.3566 121.4267 129.4100 132.9922 (72)												
Total internal gains	584.6440 582.3371 563.0457 531.3912 498.2274 467.0464 447.2766 453.9643 470.6474 502.5412 539.2536 567.7723 (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					11.4300	10.6334	0.6300	0.7000	0.7700	37.1441 (74)		
East					2.0700	19.6403	0.6300	0.7000	0.7700	12.4248 (76)		
South					14.0500	46.7521	0.6300	0.7000	0.7700	200.7469 (78)		
West					7.1600	19.6403	0.6300	0.7000	0.7700	42.9766 (80)		
Solar gains	293.2925	508.1330	717.8979	927.3819	1073.2471	1080.6449	1035.5498	924.4218	790.0879	567.7071	352.8547	249.9884 (83)
Total gains	877.9364	1090.4701	1280.9437	1458.7731	1571.4745	1547.6913	1482.8264	1378.3861	1260.7353	1070.2482	892.1082	817.7607 (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 59.0259 59.1800 59.3318 60.0555 60.1928 60.8406 60.8406 60.9621 60.5895 60.1928 59.9156 59.6285												
alpha 4.9351 4.9453 4.9555 5.0037 5.0129 5.0560 5.0560 5.0641 5.0393 5.0129 4.9944 4.9752												
util living area 0.9991 0.9973 0.9913 0.9689 0.8998 0.7486 0.5772 0.6369 0.8725 0.9833 0.9979 0.9994 (86)												
MIT 19.6299 19.8116 20.0878 20.4415 20.7478 20.9327 20.9855 20.9767 20.8447 20.4356 19.9641 19.6027 (87)												
Th 2 19.9388 19.9413 19.9437 19.9551 19.9572 19.9672 19.9672 19.9690 19.9633 19.9572 19.9529 19.9484 (88)												
util rest of house 0.9988 0.9963 0.9881 0.9564 0.8591 0.6579 0.4510 0.5095 0.8063 0.9745 0.9970 0.9992 (89)												
MIT 2 18.1028 18.3701 18.7738 19.2889 19.7032 19.9209 19.9617 19.9591 19.8340 19.2886 18.6018 18.0698 (90)												
Living area fraction fLA = Living area / (4) = 0.1178 (91)												
MIT 18.2827 18.5399 18.9285 19.4247 19.8262 20.0401 20.0823 20.0790 19.9531 19.4237 18.7622 18.2503 (92)												
Temperature adjustment 0.0000												
adjusted MIT 18.2827 18.5399 18.9285 19.4247 19.8262 20.0401 20.0823 20.0790 19.9531 19.4237 18.7622 18.2503 (93)												

8. Space heating requirement

Utilisation 0.9981 0.9943 0.9835 0.9480 0.8530 0.6649 0.4657 0.5239 0.8055 0.9680 0.9953 0.9986 (94)												
Useful gains 876.2331 1084.3037 1259.8263 1382.9036 1340.4155 1029.1338 690.5490 722.1643 1015.4722 1036.0245 887.9213 816.6400 (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 2892.5374 2814.2764 2557.7796 2139.8634 1648.4433 1091.8052 698.8748 736.8792 1179.5525 1789.9407 2376.6898 2877.1554 (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 1500.1304 1162.5416 965.6772 545.0111 229.1727 0.0000 0.0000 0.0000 0.0000 560.9136 1071.9133 1533.0234 (98)												
Space heating 7568.3833 (98)												
Space heating per m2 (98) / (4) = 43.0438 (99)												

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													8094.5276 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1500.1304	1162.5416	965.6772	545.0111	229.1727	0.0000	0.0000	0.0000	0.0000	560.9136	1071.9133	1533.0234	(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)	1604.4175	1243.3600	1032.8099	582.8996	245.1045	0.0000	0.0000	0.0000	0.0000	599.9076	1146.4313	1639.5972	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	225.7742	199.0350	209.1173	187.5801	183.9094	164.4551	158.0607	173.2774	172.9199	194.5038	205.5167	220.3828	(64)
Efficiency of water heater (217)m	88.9400	88.7603	88.3903	87.4960	85.4018	79.8000	79.8000	79.8000	79.8000	87.4798	88.5890	79.8000	(216)
Fuel for water heating, kWh/month	253.8502	224.2389	236.5839	214.3869	215.3461	206.0841	198.0710	217.1395	216.6916	222.3413	231.9891	247.6209	(219)
Water heating fuel used												2684.3434	(219)
Annual totals kWh/year													
Space heating fuel - main system												8094.5276	(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)												551.6687	(232)
Total delivered energy for all uses												11405.5397	(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	8094.5276	0.2160	1748.4180 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2684.3434	0.2160	579.8182 (264)
Space and water heating			2328.2361 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	551.6687	0.5190	286.3161 (268)
Total CO2, kg/m2/year			2653.4772 (272)
Emissions per m2 for space and water heating			13.2414 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6284 (272b)
Emissions per m2 for pumps and fans			0.2214 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.2414 * 1.00) + 1.6284 + 0.2214, rounded to 2 d.p.			15.0900 (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	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (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) = 0.0888 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3388 (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) =	0.3388 (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	0.4319	0.4235	0.4150	0.3726	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981 (22b)
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792 (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)			28.4100	1.3258	37.6648		(27)
French Doors (Uw = 1.50)			6.3000	1.4151	8.9151		(27)
Ground Floor			90.2500	0.1200	10.8300	110.0000	9927.5000 (28a)
External Walls	206.7900	36.8100	169.9800	0.1900	32.2962	60.0000	10198.8000 (29a)
Pitched Cold Roof	85.5800		85.5800	0.1000	8.5580	9.0000	770.2200 (30)
Bay Roof	4.6700		4.6700	0.1000	0.4670	9.0000	42.0300 (30)
Total net area of external elements Aum(A, m ²)			387.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.0911		(33)
Internal Wall - Masonry			94.9900			75.0000	7124.2500 (32c)
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)
Internal Floor			85.5800			18.0000	1540.4400 (32d)
Internal Ceiling			85.5800			9.0000	770.2200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 31661.9000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.0711 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7481 (36)
Total fabric heat loss							(33) + (36) = 121.8392 (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	88.2212	87.6826	87.1546	84.6748	84.2108	82.0510	82.0510	81.6510	82.8829	84.2108	85.1494	86.1307 (38)
Heat transfer coeff	210.0604	209.5218	208.9938	206.5140	206.0500	203.8901	203.8901	203.4902	204.7221	206.0500	206.9886	207.9699 (39)
Average = Sum(39)m / 12 =												206.5117 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1947	1.1916	1.1886	1.1745	1.1719	1.1596	1.1596	1.1573	1.1643	1.1719	1.1772	1.1828 (40)
HLP (average)												1.1745 (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												2.9703 (42)
Average daily hot water use (litres/day)												104.7452 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy conte	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1648.0491 (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	36.3093	31.7564	32.7697	28.5694	27.4131	23.6554	21.9202	25.1537	25.4542	29.6644	32.3810	35.1636 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2378	27.7451	22.5638	17.0823	12.7692	10.7803	11.6485	15.1412	20.3224	25.8040	30.1171	32.1060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.4497	351.0551	341.9695	322.6274	298.2114	275.2638	259.9334	256.3279	265.4135	284.7557	309.1717	332.1193	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	(71)
Water heating gains (Table 5)	48.8029	47.2565	44.0453	39.6798	36.8455	32.8547	29.4626	33.8088	35.3530	39.8715	44.9736	47.2630	(72)
Total internal gains	495.0451	493.6116	476.1335	446.9443	415.3809	386.4536	368.5993	372.8327	388.6438	417.9860	451.8172	479.0430	(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					11.4300	10.6334		0.6300	0.7000	0.7700		37.1441 (74)	
East					2.0700	19.6403		0.6300	0.7000	0.7700		12.4248 (76)	
South					7.7500	46.7521		0.6300	0.7000	0.7700		110.7323 (78)	
West					7.1600	19.6403		0.6300	0.7000	0.7700		42.9766 (80)	
South					6.3000	46.7521		0.6300	0.7000	0.7700		90.0146 (78)	

Solar gains	293.2925	508.1330	717.8979	927.3819	1073.2471	1080.6449	1035.5498	924.4218	790.0879	567.7071	352.8547	249.9884	(83)
Total gains	788.3376	1001.7445	1194.0314	1374.3262	1488.6281	1467.0985	1404.1492	1297.2546	1178.7317	985.6930	804.6718	729.0315	(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	41.8688	41.9764	42.0825	42.5878	42.6837	43.1358	43.1358	43.2206	42.9605	42.6837	42.4901	42.2896	
alpha	3.7913	3.7984	3.8055	3.8392	3.8456	3.8757	3.8757	3.8814	3.8640	3.8456	3.8327	3.8193	
util living area	0.9973	0.9930	0.9823	0.9520	0.8803	0.7459	0.5931	0.6505	0.8595	0.9721	0.9945	0.9980	(86)
MIT	19.1528	19.3846	19.7376	20.1883	20.5866	20.8560	20.9560	20.9369	20.7269	20.1917	19.5847	19.1174	(87)
Th 2	19.9243	19.9267	19.9291	19.9404	19.9426	19.9525	19.9525	19.9543	19.9487	19.9426	19.9383	19.9338	(88)
util rest of house	0.9966	0.9912	0.9774	0.9377	0.8424	0.6646	0.4710	0.5304	0.8006	0.9613	0.9928	0.9975	(89)
MIT 2	18.2300	18.4628	18.8148	19.2646	19.6394	19.8729	19.9373	19.9302	19.7753	19.2756	18.6718	18.2018	(90)
Living area fraction									fLA = Living area / (4) =			0.1178	(91)
MIT	18.3387	18.5713	18.9235	19.3734	19.7510	19.9887	20.0573	20.0488	19.8874	19.3835	18.7794	18.3097	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3387	18.5713	18.9235	19.3734	19.7510	19.9887	20.0573	20.0488	19.8874	19.3835	18.7794	18.3097	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9951	0.9879	0.9712	0.9281	0.8342	0.6678	0.4841	0.5423	0.7964	0.9535	0.9901	0.9963	(94)
Useful gains	784.4456	989.6241	1159.6600	1275.4515	1241.8859	979.6866	679.7391	703.5290	938.7942	939.9062	796.7115	726.3434	(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	2948.9738	2864.4415	2596.4358	2162.8934	1658.9019	1098.7036	704.9017	742.4935	1184.8010	1809.8477	2417.4955	2934.3828	(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	1610.4090	1259.8773	1068.9612	638.9582	310.2599	0.0000	0.0000	0.0000	0.0000	647.2364	1166.9645	1642.7813	(98)
Space heating												8345.4476	(98)
Space heating per m2										(98) / (4) =		47.4632	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1916.5673	1508.7870	1546.5253	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7804	0.8535	0.8200	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1495.6587	1287.6871	1268.2114	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1848.9370	1772.1257	1649.9324	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	254.3604	360.4224	284.0004	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												898.7832	(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	63.5901	90.1056	71.0001	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												224.6958	(107)
Space cooling per m2												1.2779	(108)
Energy for space heating												47.4632	(99)
Energy for space cooling												1.2779	(108)
Total												48.7411	(109)
Dwelling Fabric Energy Efficiency (DFEE)												48.7	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.0888 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3388 (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) =	0.3388 (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	0.4319	0.4235	0.4150	0.3726	0.3642	0.3218	0.3218	0.3134	0.3388	0.3642	0.3811	0.3981 (22b)
Effective ac	0.5933	0.5897	0.5861	0.5694	0.5663	0.5518	0.5518	0.5491	0.5574	0.5663	0.5726	0.5792 (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)			34.7100	1.3258	46.0170		(27)
Ground Floor			90.2500	0.1300	11.7325		(28a)
External Walls	206.7900	36.8100	169.9800	0.1800	30.5964		(29a)
Pitched Cold Roof	85.5800		85.5800	0.1300	11.1254		(30)
Bay Roof	4.6700		4.6700	0.1300	0.6071		(30)
Total net area of external elements Aum(A, m ²)			387.2900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	102.1784	(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)							16.4657 (36)
Total fabric heat loss						(33) + (36) =	118.6441 (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	88.2212	87.6826	87.1546	84.6748	84.2108	82.0510	82.0510	81.6510	82.8829	84.2108	85.1494	86.1307 (38)
Heat transfer coeff	206.8654	206.3267	205.7988	203.3189	202.8550	200.6951	200.6951	200.2951	201.5271	202.8550	203.7936	204.7748 (39)
Average = Sum(39)m / 12 =												203.3167 (39)
HLP	1.1765	1.1734	1.1704	1.1563	1.1537	1.1414	1.1414	1.1391	1.1461	1.1537	1.1590	1.1646 (40)
HLP (average)												1.1563 (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												2.9703 (42)
Average daily hot water use (litres/day)												104.7452 (43)
Daily hot water use	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy conte	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)
Energy content (annual)												Total = Sum(45)m = 1648.0491 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.3093	31.7564	32.7697	28.5694	27.4131	23.6554	21.9202	25.1537	25.4542	29.6644	32.3810	35.1636 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	148.5161	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.2378	27.7451	22.5638	17.0823	12.7692	10.7803	11.6485	15.1412	20.3224	25.8040	30.1171	32.1060	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.4497	351.0551	341.9695	322.6274	298.2114	275.2638	259.9334	256.3279	265.4135	284.7557	309.1717	332.1193	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	37.8516	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	(71)
Water heating gains (Table 5)	48.8029	47.2565	44.0453	39.6798	36.8455	32.8547	29.4626	33.8088	35.3530	39.8715	44.9736	47.2630	(72)
Total internal gains	495.0451	493.6116	476.1335	446.9443	415.3809	386.4536	368.5993	372.8327	388.6438	417.9860	451.8172	479.0430	(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	11.4300	10.6334	0.6300	0.7000	0.7700	37.1441	(74)
East	2.0700	19.6403	0.6300	0.7000	0.7700	12.4248	(76)
South	14.0500	46.7521	0.6300	0.7000	0.7700	200.7469	(78)
West	7.1600	19.6403	0.6300	0.7000	0.7700	42.9766	(80)

Solar gains	293.2925	508.1330	717.8979	927.3819	1073.2471	1080.6449	1035.5498	924.4218	790.0879	567.7071	352.8547	249.9884	(83)
Total gains	788.3376	1001.7445	1194.0314	1374.3262	1488.6281	1467.0985	1404.1492	1297.2546	1178.7317	985.6930	804.6718	729.0315	(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	59.0259	59.1800	59.3318	60.0555	60.1928	60.8406	60.8406	60.9621	60.5895	60.1928	59.9156	59.6285	
alpha	4.9351	4.9453	4.9555	5.0037	5.0129	5.0560	5.0560	5.0641	5.0393	5.0129	4.9944	4.9752	
util living area	0.9995	0.9981	0.9936	0.9753	0.9153	0.7749	0.6051	0.6686	0.8951	0.9881	0.9987	0.9996	(86)
MIT	19.5825	19.7650	20.0433	20.4026	20.7203	20.9210	20.9821	20.9711	20.8207	20.3938	19.9180	19.5556	(87)
Th 2	19.9388	19.9413	19.9437	19.9551	19.9572	19.9672	19.9672	19.9690	19.9633	19.9572	19.9529	19.9484	(88)
util rest of house	0.9993	0.9975	0.9911	0.9650	0.8787	0.6858	0.4750	0.5386	0.8354	0.9816	0.9981	0.9995	(89)
MIT 2	18.6379	18.8222	19.1012	19.4635	19.7614	19.9292	19.9625	19.9604	19.8581	19.4605	18.9844	18.6187	(90)
Living area fraction									fLA = Living area / (4) =			0.1178	(91)
MIT	18.7492	18.9332	19.2121	19.5741	19.8743	20.0460	20.0826	20.0794	19.9715	19.5704	19.0944	18.7290	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7492	18.9332	19.2121	19.5741	19.8743	20.0460	20.0826	20.0794	19.9715	19.5704	19.0944	18.7290	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9990	0.9966	0.9887	0.9601	0.8752	0.6934	0.4903	0.5536	0.8360	0.9782	0.9974	0.9993	(94)
Ext temp.	787.5296	998.2966	1180.5940	1319.5589	1302.8910	1017.3499	688.4628	718.1965	985.4362	964.2531	802.5693	728.5279	(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	2989.0324	2895.4279	2616.1441	2170.2460	1658.2031	1092.9883	698.9310	736.9686	1183.2618	1819.6985	2444.3760	2975.1768	(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 per m2	1637.9180	1274.8722	1068.0493	612.4947	264.3522	0.0000	0.0000	0.0000	0.0000	636.4513	1182.1008	1671.5068	(98)
										(98) / (4) =		47.4762	(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	1886.5341	1485.1439	1522.2431	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8264	0.8991	0.8668	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1558.9555	1335.2930	1319.5001	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1848.9370	1772.1257	1649.9324	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	208.7867	325.0036	245.8417	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												779.6319 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	52.1967	81.2509	61.4604	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												194.9080 (107)
Energy for space heating												1.1085 (108)
Energy for space cooling												47.4762 (99)
Total												1.1085 (108)
Target Fabric Energy Efficiency (TFEE)												48.5847 (109)
												55.9 (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	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (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)			28.4100	1.3258	37.6648		(27)					
French Doors (Uw = 1.50)			6.3000	1.4151	8.9151		(27)					
Ground Floor			90.2500	0.1200	10.8300	110.0000	9927.5000 (28a)					
External Walls	206.7900	36.8100	169.9800	0.1900	32.2962	60.0000	10198.8000 (29a)					
Pitched Cold Roof	85.5800		85.5800	0.1000	8.5580	9.0000	770.2200 (30)					
Bay Roof	4.6700		4.6700	0.1000	0.4670	9.0000	42.0300 (30)					
Total net area of external elements Aum(A, m2)			387.2900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.0911		(33)					
Internal Wall - Masonry			94.9900			75.0000	7124.2500 (32c)					
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)					
Internal Floor			85.5800			18.0000	1540.4400 (32d)					
Internal Ceiling			85.5800			18.0000	1540.4400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		32432.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							184.4516 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7481 (36)					
Total fabric heat loss						(33) + (36) =	121.8392 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 79.9264	Feb 76.2089	Mar 75.2795	Apr 74.3502	May 76.2089	Jun 74.3502	Jul 74.3502	Aug 74.3502	Sep 74.3502	Oct 74.3502	Nov 74.3502	Dec 75.2795 (38)
Heat transfer coeff	201.7656	198.0481	197.1187	196.1893	198.0481	196.1893	196.1893	196.1893	196.1893	196.1893	196.1893	197.1187 (39)
Average = Sum(39)m / 12 =												197.1187 (39)
HLP	Jan 1.1475	Feb 1.1264	Mar 1.1211	Apr 1.1158	May 1.1264	Jun 1.1158	Jul 1.1158	Aug 1.1158	Sep 1.1158	Oct 1.1158	Nov 1.1158	Dec 1.1211 (40)
HLP (average)												1.1211 (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												2.9703 (42)
Average daily hot water use (litres/day)												104.7452 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use												
Energy conte	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy content (annual)	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)
Distribution loss (46)m = 0.15 x (45)m	Total = Sum (45)m = 1648.0491 (45)											
	25.6301	22.4163	23.1316	20.1667	19.3504	16.6979	15.4731	17.7556	17.9676	20.9396	22.8572	24.8214 (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												
Solar input	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
	Solar input (sum of months) = Sum (63)m = 0.0000 (63)											
Output from w/h	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (64)
	Total per year (kWh/year) = Sum (64)m = 2365.4201 (64)											
RHI water heating demand	2365 (64)											
Heat gains from water heating, kWh/month	105.5553	93.7143	100.0169	91.8724	91.6353	84.1833	83.0406	88.1001	86.9979	95.1579	97.8363	103.7627 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.0944	69.3628	56.4096	42.7057	31.9230	26.9507	29.1212	37.8529	50.8060	64.5100	75.2926	80.2649 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	518.5816	523.9629	510.4023	481.5334	445.0916	410.8415	387.9603	382.5790	396.1396	425.0085	461.4503	495.7004 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129 (71)
Water heating gains (Table 5)	141.8755	139.4559	134.4313	127.6005	123.1657	116.9213	111.6137	118.4142	120.8304	127.9005	135.8838	139.4660 (72)
Total internal gains	856.7502	850.9802	819.4419	770.0383	718.3790	672.9122	646.8939	657.0448	685.9747	735.6176	790.8254	833.6300 (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				11.4300	14.6401	0.6300	0.7000		0.7700		51.1401 (74)	
East				2.0700	27.3735	0.6300	0.7000		0.7700		17.3170 (76)	
South				7.7500	61.3950	0.6300	0.7000		0.7700		145.4140 (78)	
West				7.1600	27.3735	0.6300	0.7000		0.7700		59.8983 (80)	
South				6.3000	61.3950	0.6300	0.7000		0.7700		118.2075 (78)	
Solar gains	391.9769	558.5226	789.6798	1051.0848	1180.7541	1274.7613	1219.9347	1086.5773	926.9185	666.4650	452.1583	324.0942 (83)
Total gains	1248.7271	1409.5028	1609.1217	1821.1231	1899.1332	1947.6735	1866.8286	1743.6221	1612.8932	1402.0826	1242.9837	1157.7242 (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	44.6504	45.4886	45.7030	45.9195	45.4886	45.9195	45.9195	45.9195	45.9195	45.9195	45.9195	45.7030
alpha	3.9767	4.0326	4.0469	4.0613	4.0326	4.0613	4.0613	4.0613	4.0613	4.0613	4.0613	4.0469
util living area	0.9849	0.9750	0.9452	0.8670	0.7230	0.5050	0.3437	0.3564	0.6364	0.8828	0.9686	0.9877 (86)
MIT	19.6936	19.8782	20.2132	20.5933	20.8568	20.9752	20.9961	20.9957	20.9376	20.6414	20.1388	19.7032 (87)
Th 2	19.9622	19.9794	19.9837	19.9880	19.9794	19.9880	19.9880	19.9880	19.9880	19.9880	19.9880	19.9837 (88)
util rest of house	0.9810	0.9688	0.9313	0.8343	0.6589	0.4144	0.2399	0.2456	0.5437	0.8444	0.9590	0.9844 (89)
MIT 2	18.2507	18.5282	19.0082	19.5307	19.8494	19.9736	19.9869	19.9869	19.9453	19.6067	18.9123	18.2796 (90)
Living area fraction	18.4207	18.6872	19.1501	19.6558	19.9681	20.0916	20.1058	20.1057	20.0622	19.7286	19.0568	18.4472 (92)
MIT	18.4207	18.6872	19.1501	19.6558	19.9681	20.0916	20.1058	20.1057	20.0622	19.7286	19.0568	18.4472 (93)
Temperature adjustment	0.0000											
adjusted MIT	18.4207	18.6872	19.1501	19.6558	19.9681	20.0916	20.1058	20.1057	20.0622	19.7286	19.0568	18.4472 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9727	0.9580	0.9169	0.8219	0.6581	0.4240	0.2521	0.2586	0.5509	0.8325	0.9471	0.9773 (94)
Useful gains	1214.6817	1350.2941	1475.3433	1496.6983	1249.8247	825.8713	470.6633	450.9538	888.6072	1167.2618	1177.2676	1131.4265 (95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	2647.2970	2572.0973	2316.1676	1913.9877	1380.0137	841.9578	471.9891	452.3524	934.2902	1516.2694	2090.7519	2552.1437	(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	1065.8658	821.0518	625.5733	300.4483	96.8606	0.0000	0.0000	0.0000	0.0000	259.6617	657.7087	1057.0136	(98)
RHI space heating demand												4884.1839	(98)
												4884	(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	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3188	0.3125	0.3063	0.2750	0.2688	0.2375	0.2375	0.2313	0.2500	0.2688	0.2813	0.2938 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5688	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5313	0.5438 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1000	1.6000	3.3600		(26)
Windows (Uw = 1.40)			28.4100	1.3258	37.6648		(27)
French Doors (Uw = 1.50)			6.3000	1.4151	8.9151		(27)
Ground Floor			90.2500	0.1200	10.8300	110.0000	9927.5000 (28a)
External Walls	206.7900	36.8100	169.9800	0.1900	32.2962	60.0000	10198.8000 (29a)
Pitched Cold Roof	85.5800		85.5800	0.1000	8.5580	9.0000	770.2200 (30)
Bay Roof	4.6700		4.6700	0.1000	0.4670	9.0000	42.0300 (30)
Total net area of external elements Aum(A, m ²)			387.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.0911		(33)
Internal Wall - Masonry			94.9900			75.0000	7124.2500 (32c)
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)
Internal Floor			85.5800			18.0000	1540.4400 (32d)
Internal Ceiling			85.5800			18.0000	1540.4400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 32432.1200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 184.4516 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 19.7481 (36)
Total fabric heat loss (33) + (36) = 121.8392 (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	84.5733	83.6439	82.7145	78.0677	77.1383	74.3502	74.3502	74.3502	74.3502	77.1383	78.9970	80.8558 (38)
Heat transfer coeff	206.4125	205.4831	204.5537	199.9068	198.9775	196.1893	196.1893	196.1893	196.1893	198.9775	200.8362	202.6950 (39)
Average = Sum(39)m / 12 =												200.2166 (39)
HLP	1.1739	1.1686	1.1634	1.1369	1.1316	1.1158	1.1158	1.1158	1.1158	1.1316	1.1422	1.1528 (40)
HLP (average)												1.1387 (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												2.9703 (42)
Average daily hot water use (litres/day)												104.7452 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy conte	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)
Energy content (annual)										Total = Sum(45)m =		1648.0491 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6301	22.4163	23.1316	20.1667	19.3504	16.6979	15.4731	17.7556	17.9676	20.9396	22.8572	24.8214 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (64)
Heat gains from water heating, kWh/month	105.5553	93.7143	100.0169	91.8724	91.6353	84.1833	83.0406	88.1001	86.9979	95.1579	97.8363	103.7627 (65)
Total per year (kWh/year) = Sum(64)m =												2365.4201 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.0944	69.3628	56.4096	42.7057	31.9230	26.9507	29.1212	37.8529	50.8060	64.5100	75.2926	80.2649 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	518.5816	523.9629	510.4023	481.5334	445.0916	410.8415	387.9603	382.5790	396.1396	425.0085	461.4503	495.7004 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129 (71)
Water heating gains (Table 5)	141.8755	139.4559	134.4313	127.6005	123.1657	116.9213	111.6137	118.4142	120.8304	127.9005	135.8838	139.4660 (72)
Total internal gains	856.7502	850.9802	819.4419	770.0383	718.3790	672.9122	646.8939	657.0448	685.9747	735.6176	790.8254	833.6300 (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						11.4300	10.6334	0.6300	0.7000			0.7700			37.1441 (74)
East						2.0700	19.6403	0.6300	0.7000			0.7700			12.4248 (76)
South						7.7500	46.7521	0.6300	0.7000			0.7700			110.7323 (78)
West						7.1600	19.6403	0.6300	0.7000			0.7700			42.9766 (80)
South						6.3000	46.7521	0.6300	0.7000			0.7700			90.0146 (78)
Solar gains	293.2925	508.1330	717.8979	927.3819	1073.2471	1080.6449	1035.5498	924.4218	790.0879	567.7071	352.8547	249.9884			(83)
Total gains	1150.0426	1359.1132	1537.3398	1697.4202	1791.6262	1753.5571	1682.4437	1581.4666	1476.0626	1303.3247	1143.6800	1083.6184			(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.6452	43.8426	44.0418	45.0656	45.2761	45.9195	45.9195	45.9195	45.9195	45.2761	44.8571	44.4457
alpha	3.9097	3.9228	3.9361	4.0044	4.0184	4.0613	4.0613	4.0613	4.0613	4.0184	3.9905	3.9630
util living area	0.9908	0.9818	0.9623	0.9130	0.8135	0.6518	0.4959	0.5440	0.7663	0.9360	0.9830	0.9927 (86)
MIT	19.4537	19.6757	20.0014	20.4126	20.7340	20.9235	20.9803	20.9714	20.8488	20.4252	19.8745	19.4314 (87)
Th 2	19.9409	19.9452	19.9494	19.9708	19.9751	19.9880	19.9880	19.9880	19.9880	19.9751	19.9665	19.9580 (88)
util rest of house	0.9885	0.9773	0.9527	0.8904	0.7656	0.5696	0.3895	0.4357	0.6941	0.9145	0.9781	0.9908 (89)
MIT 2	17.8881	18.2125	18.6837	19.2762	19.7026	19.9300	19.9787	19.9732	19.8581	19.3076	18.5177	17.8668 (90)
Living area fraction									fLA = Living area / (4) =			0.1178 (91)
MIT	18.0725	18.3848	18.8389	19.4100	19.8241	20.0470	20.0967	20.0908	19.9748	19.4392	18.6775	18.0511 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0725	18.3848	18.8389	19.4100	19.8241	20.0470	20.0967	20.0908	19.9748	19.4392	18.6775	18.0511 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9825	0.9679	0.9392	0.8754	0.7576	0.5747	0.4014	0.4473	0.6931	0.9002	0.9692	0.9858 (94)
Ext temp.	1129.9025	1315.4579	1443.8750	1485.9030	1357.3053	1007.8434	675.2619	707.3230	1023.0512	1173.1919	1108.4120	1068.1866 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2842.8109	2770.9044	2523.9615	2101.0284	1616.5118	1068.6528	686.0057	724.0896	1152.5720	1758.8108	2325.1850	2807.5430 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1274.4039	978.0600	803.5843	442.8903	192.8497	0.0000	0.0000	0.0000	0.0000	435.7005	876.0766	1294.0811 (98)
Space heating												6297.6463 (98)
Space heating per m2											(98) / (4) =	35.8167 (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												6951.0445 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1274.4039	978.0600	803.5843	442.8903	192.8497	0.0000	0.0000	0.0000	0.0000	435.7005	876.0766	1294.0811 (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)	1406.6268	1079.5365	886.9584	488.8414	212.8584	0.0000	0.0000	0.0000	0.0000	480.9056	966.9719	1428.3456 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (64)
Efficiency of water heater (217)m	88.7705	88.5496	88.1082	87.0564	84.9549	79.9000	79.9000	79.9000	79.9000	86.9308	88.3018	79.9000 (216)
Fuel for water heating, kWh/month	261.1169	230.9136	244.1747	222.1623	223.5657	213.1183	205.3583	224.4030	223.7125	230.6713	239.3419	254.8764 (219)
Water heating fuel used												2773.4147 (219)
Annual totals kWh/year												
Space heating fuel - main system												6951.0445 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)												
mechanical ventilation fans (SFP = 0.2681)												147.3927 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												222.3927 (231)
Electricity for lighting (calculated in Appendix L)												551.6687 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.36 * 1068 * 1.00) =									-1162.0607			-1162.0607 (233)
Total delivered energy for all uses												9336.4599 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6951.0445	3.4800	241.8963 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2773.4147	3.4800	96.5148 (247)
Mechanical ventilation fans	147.3927	13.1900	19.4411 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	551.6687	13.1900	72.7651 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1162.0607	13.1900	-153.2758 (252)
Total energy cost			407.2341 (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] =	0.7745 (257)
SAP value		89.1954
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6951.0445	0.2160	1501.4256 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2773.4147	0.2160	599.0576 (264)
Space and water heating			2100.4832 (265)
Pumps and fans	222.3927	0.5190	115.4218 (267)
Energy for lighting	551.6687	0.5190	286.3161 (268)

FULL SAP CALCULATION PRINTOUT

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Energy saving/generation technologies			
PV Unit	-1162.0607	0.5190	-603.1095 (269)
Total kg/year			1899.1116 (272)
CO2 emissions per m2			10.8000 (273)
EI value			88.4762
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	$3.48 / 0.8509 = 4.090$, stars = 4
Water heating environmental impact	$0.216 / 0.8509 = 0.2538$, 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	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (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)			28.4100	1.3258	37.6648		(27)					
French Doors (Uw = 1.50)			6.3000	1.4151	8.9151		(27)					
Ground Floor			90.2500	0.1200	10.8300	110.0000	9927.5000 (28a)					
External Walls	206.7900	36.8100	169.9800	0.1900	32.2962	60.0000	10198.8000 (29a)					
Pitched Cold Roof	85.5800		85.5800	0.1000	8.5580	9.0000	770.2200 (30)					
Bay Roof	4.6700		4.6700	0.1000	0.4670	9.0000	42.0300 (30)					
Total net area of external elements Aum(A, m2)			387.2900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		102.0911		(33)					
Internal Wall - Masonry			94.9900			75.0000	7124.2500 (32c)					
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)					
Internal Floor			85.5800			18.0000	1540.4400 (32d)					
Internal Ceiling			85.5800			18.0000	1540.4400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		32432.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							184.4516 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7481 (36)					
Total fabric heat loss						(33) + (36) =	121.8392 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 79.9264	Feb 76.2089	Mar 75.2795	Apr 74.3502	May 76.2089	Jun 74.3502	Jul 74.3502	Aug 74.3502	Sep 74.3502	Oct 74.3502	Nov 74.3502	Dec 75.2795 (38)
Heat transfer coeff	201.7656	198.0481	197.1187	196.1893	198.0481	196.1893	196.1893	196.1893	196.1893	196.1893	196.1893	197.1187 (39)
Average = Sum(39)m / 12 =												197.1187 (39)
HLP	Jan 1.1475	Feb 1.1264	Mar 1.1211	Apr 1.1158	May 1.1264	Jun 1.1158	Jul 1.1158	Aug 1.1158	Sep 1.1158	Oct 1.1158	Nov 1.1158	Dec 1.1211 (40)
HLP (average)												1.1211 (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												2.9703 (42)
Average daily hot water use (litres/day)												104.7452 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy conte	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)
Energy content (annual)												1648.0491 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6301	22.4163	23.1316	20.1667	19.3504	16.6979	15.4731	17.7556	17.9676	20.9396	22.8572	24.8214 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (64)
Heat gains from water heating, kWh/month	105.5553	93.7143	100.0169	91.8724	91.6353	84.1833	83.0406	88.1001	86.9979	95.1579	97.8363	103.7627 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.0944	69.3628	56.4096	42.7057	31.9230	26.9507	29.1212	37.8529	50.8060	64.5100	75.2926	80.2649 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	518.5816	523.9629	510.4023	481.5334	445.0916	410.8415	387.9603	382.5790	396.1396	425.0085	461.4503	495.7004 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129 (71)
Water heating gains (Table 5)	141.8755	139.4559	134.4313	127.6005	123.1657	116.9213	111.6137	118.4142	120.8304	127.9005	135.8838	139.4660 (72)
Total internal gains	856.7502	850.9802	819.4419	770.0383	718.3790	672.9122	646.8939	657.0448	685.9747	735.6176	790.8254	833.6300 (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					11.4300	14.6401	0.6300	0.7000	0.7700	51.1401 (74)		
East					2.0700	27.3735	0.6300	0.7000	0.7700	17.3170 (76)		
South					7.7500	61.3950	0.6300	0.7000	0.7700	145.4140 (78)		
West					7.1600	27.3735	0.6300	0.7000	0.7700	59.8983 (80)		
South					6.3000	61.3950	0.6300	0.7000	0.7700	118.2075 (78)		
Solar gains	391.9769	558.5226	789.6798	1051.0848	1180.7541	1274.7613	1219.9347	1086.5773	926.9185	666.4650	452.1583	324.0942 (83)
Total gains	1248.7271	1409.5028	1609.1217	1821.1231	1899.1332	1947.6735	1866.8286	1743.6221	1612.8932	1402.0826	1242.9837	1157.7242 (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	44.6504	45.4886	45.7030	45.9195	45.4886	45.9195	45.9195	45.9195	45.9195	45.9195	45.9195	45.7030
alpha	3.9767	4.0326	4.0469	4.0613	4.0326	4.0613	4.0613	4.0613	4.0613	4.0613	4.0613	4.0469
util living area	0.9849	0.9750	0.9452	0.8670	0.7230	0.5050	0.3437	0.3564	0.6364	0.8828	0.9686	0.9877 (86)
MIT	19.6936	19.8782	20.2132	20.5933	20.8568	20.9752	20.9961	20.9957	20.9376	20.6414	20.1388	19.7032 (87)
Th 2	19.9622	19.9794	19.9837	19.9880	19.9794	19.9880	19.9880	19.9880	19.9880	19.9880	19.9880	19.9837 (88)
util rest of house	0.9810	0.9688	0.9313	0.8343	0.6589	0.4144	0.2399	0.2456	0.5437	0.8444	0.9590	0.9844 (89)
MIT 2	18.2507	18.5282	19.0082	19.5307	19.8494	19.9736	19.9869	19.9869	19.9453	19.6067	18.9123	18.2796 (90)
Living area fraction									fLA = Living area / (4) =			0.1178 (91)
MIT	18.4207	18.6872	19.1501	19.6558	19.9681	20.0916	20.1058	20.1057	20.0622	19.7286	19.0568	18.4472 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4207	18.6872	19.1501	19.6558	19.9681	20.0916	20.1058	20.1057	20.0622	19.7286	19.0568	18.4472 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9727	0.9580	0.9169	0.8219	0.6581	0.4240	0.2521	0.2586	0.5509	0.8325	0.9471	0.9773 (94)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	2647.2970	2572.0973	2316.1676	1913.9877	1380.0137	841.9578	471.9891	452.3524	934.2902	1516.2694	2090.7519	2552.1437 (97)

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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	1065.8658	821.0518	625.5733	300.4483	96.8606	0.0000	0.0000	0.0000	0.0000	259.6617	657.7087	1057.0136 (98)
Space heating												4884.1839 (98)
Space heating per m2											(98) / (4) =	27.7779 (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												5390.9314 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1065.8658	821.0518	625.5733	300.4483	96.8606	0.0000	0.0000	0.0000	0.0000	259.6617	657.7087	1057.0136 (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)	1176.4523	906.2381	690.4783	331.6207	106.9102	0.0000	0.0000	0.0000	0.0000	286.6023	725.9478	1166.6817 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	231.7948	204.4730	215.1379	193.4065	189.9301	170.2815	164.0813	179.2980	178.7463	200.5244	211.3431	226.4034 (64)
Efficiency of water heater	88.4834	88.2438	87.5981	86.0852	83.2194	79.9000	79.9000	79.9000	79.9000	85.6046	87.7425	79.9000 (216)
Fuel for water heating, kWh/month	261.9642	231.7137	245.5966	224.6686	228.2280	213.1183	205.3583	224.4030	223.7125	234.2449	240.8675	255.7968 (219)
Water heating fuel used												2789.6724 (219)
Annual totals kWh/year												
Space heating fuel - main system												5390.9314 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 14.2100, total flow = 53.0000, SFP = 0.2681)												
mechanical ventilation fans (SFP = 0.2681)												147.3927 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												222.3927 (231)
Electricity for lighting (calculated in Appendix L)												551.6687 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.36 * 1246 * 1.00) =									-1355.6655			-1355.6655 (233)
Total delivered energy for all uses												7598.9997 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5390.9314	3.6300	195.6908 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2789.6724	3.6300	101.2651 (247)
Mechanical ventilation fans	147.3927	19.4400	28.6531 (249)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	551.6687	19.4400	107.2444 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-1355.6655	19.4400	-263.5414 (252)
Total energy cost			278.8921 (255)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5390.9314	0.2160	1164.4412 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2789.6724	0.2160	602.5692 (264)
Space and water heating			1767.0104 (265)
Pumps and fans	222.3927	0.5190	115.4218 (267)
Energy for lighting	551.6687	0.5190	286.3161 (268)
Energy saving/generation technologies			
PV Unit	-1355.6655	0.5190	-703.5904 (269)
Total kg/year			1465.1579 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - main system 1	5390.9314	1.2200	6576.9363 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2789.6724	1.2200	3403.4003 (264)
Space and water heating			9980.3366 (265)
Pumps and fans	222.3927	3.0700	682.7456 (267)
Energy for lighting	551.6687	3.0700	1693.6229 (268)
Energy saving/generation technologies			
PV Unit	-1355.6655	3.0700	-4161.8931 (269)
Primary energy kWh/year			8194.8119 (272)
Primary energy kWh/m ² /year			46.6064 (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	+ 1.1	-£ 42	-280 kg (19.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£42	1.59 kg/m ²	B 90
Total Savings	£42	1.59 kg/m ²	B 90

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

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

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

	Current	Potential	Saving
Electricity	£150	£160	-£10
Mains gas	£392	£340	£51
Space heating	£334	£336	-£2
Water heating	£101	£58	£43
Lighting	£107	£107	£0
Generated (PV)	-£264	-£264	£0
Total cost of fuels	£278	£236	£41
Total cost of uses	£278	£237	£41
Delivered energy	43 kWh/m ²	35 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	1.5 tonnes	1.2 tonnes	0.3 tonnes
CO2 emissions per m ²	8 kg/m ²	7 kg/m ²	2 kg/m ²
Primary energy	47 kWh/m ²	38 kWh/m ²	9 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.2500 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2500 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.3188	0.3125	0.3063	0.2750	0.2688	0.2375	0.2375	0.2313	0.2500	0.2688	0.2813	0.2938 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5688	0.5625	0.5563	0.5250	0.5188	0.5000	0.5000	0.5000	0.5000	0.5188	0.5313	0.5438 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Front Door			2.1000	1.6000	3.3600		(26)
Windows (Uw = 1.40)			28.4100	1.3258	37.6648		(27)
French Doors (Uw = 1.50)			6.3000	1.4151	8.9151		(27)
Ground Floor			90.2500	0.1200	10.8300	110.0000	9927.5000 (28a)
External Walls	206.7900	36.8100	169.9800	0.1900	32.2962	60.0000	10198.8000 (29a)
Pitched Cold Roof	85.5800		85.5800	0.1000	8.5580	9.0000	770.2200 (30)
Bay Roof	4.6700		4.6700	0.1000	0.4670	9.0000	42.0300 (30)
Total net area of external elements Aum(A, m ²)			387.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.0911		(33)
Internal Wall - Masonry			94.9900			75.0000	7124.2500 (32c)
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)
Internal Floor			85.5800			18.0000	1540.4400 (32d)
Internal Ceiling			85.5800			18.0000	1540.4400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	32432.1200 (34)
	184.4516 (35)
	19.7481 (36)
(33) + (36) =	121.8392 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	Jan 84.5733 Feb 83.6439 Mar 82.7145 Apr 78.0677 May 77.1383 Jun 74.3502 Jul 74.3502 Aug 74.3502 Sep 74.3502 Oct 77.1383 Nov 78.9970 Dec 80.8558 (38)
Heat transfer coeff	206.4125 205.4831 204.5537 199.9068 198.9775 196.1893 196.1893 196.1893 196.1893 198.9775 200.8362 202.6950 (39)
Average = Sum(39)m / 12 =	200.2166 (39)
HLP	Jan 1.1739 Feb 1.1686 Mar 1.1634 Apr 1.1369 May 1.1316 Jun 1.1158 Jul 1.1158 Aug 1.1158 Sep 1.1158 Oct 1.1316 Nov 1.1422 Dec 1.1528 (40)
HLP (average)	1.1387 (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											2.9703 (42)
Average daily hot water use (litres/day)											104.7452 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy conte	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	25.6301	22.4163	23.1316	20.1667	19.3504	16.6979	15.4731	17.7556	17.9676	20.9396	22.8572	24.8214 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss												
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												
	26.3655	23.8140	26.3655	25.5150	26.3655	25.5150	26.3655	26.3655	25.5150	26.3655	25.5150	26.3655 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	220.4953	194.2670	202.4427	175.7179	165.8362	146.7398	139.7548	155.9020	162.4084	187.8292	200.4081	215.1039 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1005 (H8)
Utilisation factor												0.5970 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.7452 (H14)
Volume ratio Veff/V												1.2172 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-951.9628 (H17)
Solar input	-27.6050	-46.0648	-78.4537	-105.1434	-129.8959	-127.7083	-126.0206	-110.1048	-86.2342	-58.8878	-32.7435	-23.1007 (63)
Solar input (sum of months) = Sum(63)m =												-951.9628 (63)
Output from w/h												
	192.8903	148.2021	123.9890	70.5744	35.9404	19.0314	13.7342	45.7972	76.1742	128.9414	167.6646	192.0032 (64)
Total per year (kWh/year) = Sum(64)m =												1214.9425 (64)
Heat gains from water heating, kWh/month												
	96.5157	85.5495	89.8607	77.7215	72.3602	65.3500	63.5794	69.3834	73.9276	85.0017	89.0883	94.7231 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	78.0944	69.3628	56.4096	42.7057	31.9230	26.9507	29.1212	37.8529	50.8060	64.5100	75.2926	80.2649 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	518.5816	523.9629	510.4023	481.5334	445.0916	410.8415	387.9603	382.5790	396.1396	425.0085	461.4503	495.7004 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129 (71)
Water heating gains (Table 5)												
	129.7255	127.3059	120.7805	107.9465	97.2584	90.7638	85.4562	93.2572	102.6772	114.2497	123.7338	127.3160 (72)
Total internal gains												
	844.6002	838.8302	805.7911	750.3843	692.4717	646.7547	620.7364	631.8878	667.8215	721.9668	778.6754	821.4800 (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					11.4300	10.6334		0.6300	0.7000		0.7700		37.1441 (74)	
East					2.0700	19.6403		0.6300	0.7000		0.7700		12.4248 (76)	
South					7.7500	46.7521		0.6300	0.7000		0.7700		110.7323 (78)	
West					7.1600	19.6403		0.6300	0.7000		0.7700		42.9766 (80)	
South					6.3000	46.7521		0.6300	0.7000		0.7700		90.0146 (78)	
Solar gains	293.2925	508.1330	717.8979	927.3819	1073.2471	1080.6449	1035.5498	924.4218	790.0879	567.7071	352.8547	249.9884	(83)	
Total gains	1137.8926	1346.9632	1523.6890	1677.7662	1765.7189	1727.3996	1656.2862	1556.3097	1457.9094	1289.6739	1131.5300	1071.4684	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.6452	43.8426	44.0418	45.0656	45.2761	45.9195	45.9195	45.9195	45.9195	45.2761	44.8571	44.4457
alpha	3.9097	3.9228	3.9361	4.0044	4.0184	4.0613	4.0613	4.0613	4.0613	4.0184	3.9905	3.9630
util living area												
	0.9912	0.9823	0.9633	0.9157	0.8191	0.6590	0.5028	0.5514	0.7716	0.9379	0.9836	0.9930 (86)
MIT	19.4459	19.6682	19.9936	20.4035	20.7265	20.9204	20.9793	20.9699	20.8446	20.4182	19.8669	19.4234 (87)
Th 2	19.9409	19.9452	19.9494	19.9708	19.9751	19.9880	19.9880	19.9880	19.9880	19.9751	19.9665	19.9580 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9890	0.9779	0.9539	0.8936	0.7718	0.5767	0.3954	0.4422	0.7000	0.9169	0.9788	0.9912 (89)
Living area fraction	17.8767	18.2017	18.6727	19.2641	19.6939	19.9274	19.9782	19.9724	19.8540	19.2983	18.5068	17.8553 (90)
MIT	18.0616	18.3744	18.8283	19.3983	19.8155	20.0444	20.0961	20.0899	fLA = Living area / (4) =			0.1178 (91)
Temperature adjustment									19.9707	19.4302	18.6670	18.0400 (92)
adjusted MIT	18.0616	18.3744	18.8283	19.3983	19.8155	20.0444	20.0961	20.0899	19.9707	19.4302	18.6670	0.0000
												18.0400 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9830	0.9687	0.9406	0.8785	0.7635	0.5816	0.4073	0.4538	0.6986	0.9026	0.9701	0.9863	(94)
Useful gains	1118.5999	1304.7909	1433.1595	1473.9843	1348.0522	1004.6928	674.5661	706.2546	1018.4816	1164.0471	1097.7033	1056.7409	(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	2840.5566	2768.7628	2521.7999	2098.6910	1614.8024	1068.1251	685.8933	723.9162	1151.7671	1757.0134	2323.0735	2805.2973	(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	1281.1358	983.7892	809.9485	449.7888	198.4621	0.0000	0.0000	0.0000	0.0000	441.1670	882.2666	1300.9260	(98)
Space heating												6347.4839	(98)
Space heating per m2												(98) / (4) =	36.1001 (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	7006.0529 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1281.1358	983.7892	809.9485	449.7888	198.4621	0.0000	0.0000	0.0000	0.0000	441.1670	882.2666	1300.9260	(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)	1414.0572	1085.8600	893.9829	496.4557	219.0531	0.0000	0.0000	0.0000	0.0000	486.9392	973.8041	1435.9006	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	192.8903	148.2021	123.9890	70.5744	35.9404	19.0314	13.7342	45.7972	76.1742	128.9414	167.6646	192.0032	(64)
Efficiency of water heater (217)m	89.0396	89.0389	89.0174	88.9838	88.7771	79.9000	79.9000	79.9000	79.9000	87.9366	88.7030	79.9000	(216)
Fuel for water heating, kWh/month	216.6342	166.4465	139.2862	79.3115	40.4838	23.8191	17.1893	57.3181	95.3370	146.6300	189.0178	215.5740	(219)
Water heating fuel used												1387.0475	(219)
Annual totals kWh/year													
Space heating fuel - main system												7006.0529	(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)	147.3927 (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	272.3927 (231)
Electricity for lighting (calculated in Appendix L)	551.6687 (232)
Energy saving/generation technologies (Appendices M ,N and Q)	
PV Unit 0 (0.80 * 1.36 * 1068 * 1.00) =	-1162.0607
Total delivered energy for all uses	8055.1012 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	7006.0529	3.4800	243.8106	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1387.0475	3.4800	48.2693	(247)
Mechanical ventilation fans	147.3927	13.1900	19.4411	(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	551.6687	13.1900	72.7651	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1162.0607	13.1900	-153.2758	(252)
Total energy cost			367.4978	(255)

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.6989 (257)
SAP value		90.2497
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	7006.0529	0.2160	1513.3074 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1387.0475	0.2160	299.6023 (264)
Space and water heating			1812.9097 (265)
Pumps and fans	272.3927	0.5190	141.3718 (267)
Energy for lighting	551.6687	0.5190	286.3161 (268)
Energy saving/generation technologies			
PV Unit	-1162.0607	0.5190	-603.1095 (269)
Total kg/year			1637.4881 (272)
CO2 emissions per m2			9.3100 (273)
EI value			90.0637
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	90.2500 (1b)	x 2.4800 (2b)	= 223.8200 (1b) - (3b)
First floor	85.5800 (1c)	x 2.6500 (2c)	= 226.7870 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	175.8300		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 450.6070 (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)			28.4100	1.3258	37.6648		(27)					
French Doors (Uw = 1.50)			6.3000	1.4151	8.9151		(27)					
Ground Floor			90.2500	0.1200	10.8300	110.0000	9927.5000 (28a)					
External Walls	206.7900	36.8100	169.9800	0.1900	32.2962	60.0000	10198.8000 (29a)					
Pitched Cold Roof	85.5800		85.5800	0.1000	8.5580	9.0000	770.2200 (30)					
Bay Roof	4.6700		4.6700	0.1000	0.4670	9.0000	42.0300 (30)					
Total net area of external elements Aum(A, m2)			387.2900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	102.0911		(33)					
Internal Wall - Masonry			94.9900			75.0000	7124.2500 (32c)					
Internal Wall - Timber			143.1600			9.0000	1288.4400 (32c)					
Internal Floor			85.5800			18.0000	1540.4400 (32d)					
Internal Ceiling			85.5800			18.0000	1540.4400 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		32432.1200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							184.4516 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.7481 (36)					
Total fabric heat loss						(33) + (36) =	121.8392 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 79.9264	Feb 76.2089	Mar 75.2795	Apr 74.3502	May 76.2089	Jun 74.3502	Jul 74.3502	Aug 74.3502	Sep 74.3502	Oct 74.3502	Nov 74.3502	Dec 75.2795 (38)
Heat transfer coeff	201.7656	198.0481	197.1187	196.1893	198.0481	196.1893	196.1893	196.1893	196.1893	196.1893	196.1893	197.1187 (39)
Average = Sum(39)m / 12 =												197.1187 (39)
HLP	Jan 1.1475	Feb 1.1264	Mar 1.1211	Apr 1.1158	May 1.1264	Jun 1.1158	Jul 1.1158	Aug 1.1158	Sep 1.1158	Oct 1.1158	Nov 1.1158	Dec 1.1211 (40)
HLP (average)												1.1211 (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												2.9703 (42)
Average daily hot water use (litres/day)												104.7452 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Daily hot water use	115.2197	111.0299	106.8401	102.6503	98.4604	94.2706	94.2706	98.4604	102.6503	106.8401	111.0299	115.2197 (44)
Energy conte	170.8674	149.4418	154.2105	134.4445	129.0027	111.3195	103.1539	118.3706	119.7843	139.5970	152.3811	165.4760 (45)
Energy content (annual)												1648.0491 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.6301	22.4163	23.1316	20.1667	19.3504	16.6979	15.4731	17.7556	17.9676	20.9396	22.8572	24.8214 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												2.2500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.2150 (55)
Total storage loss												
	37.6650	34.0200	37.6650	36.4500	37.6650	36.4500	37.6650	37.6650	36.4500	37.6650	36.4500	37.6650 (56)
If cylinder contains dedicated solar storage												
	26.3655	23.8140	26.3655	25.5150	26.3655	25.5150	26.3655	26.3655	25.5150	26.3655	25.5150	26.3655 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	220.4953	194.2670	202.4427	175.7179	165.8362	146.7398	139.7548	155.9020	162.4084	187.8292	200.4081	215.1039 (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												1.2943 (H8)
Utilisation factor												0.5382 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.7452 (H14)
Volume ratio Veff/V												1.2172 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-1009.4396 (H17)
Solar input	-33.9971	-46.6548	-79.2646	-108.7171	-129.6246	-136.3287	-134.4786	-117.7645	-92.6962	-63.6528	-38.6703	-27.5903 (63)
Solar input (sum of months) = Sum(63)m =												-1009.4396 (63)
Output from w/h												
	186.4982	147.6122	123.1781	67.0008	36.2116	10.4111	5.2762	38.1375	69.7122	124.1764	161.7378	187.5136 (64)
Total per year (kWh/year) = Sum(64)m =												1157.4656 (64)
Heat gains from water heating, kWh/month												
	96.5157	85.5495	89.8607	77.7215	72.3602	65.3500	63.5794	69.3834	73.9276	85.0017	89.0883	94.7231 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193	178.2193 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	78.0944	69.3628	56.4096	42.7057	31.9230	26.9507	29.1212	37.8529	50.8060	64.5100	75.2926	80.2649 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	518.5816	523.9629	510.4023	481.5334	445.0916	410.8415	387.9603	382.5790	396.1396	425.0085	461.4503	495.7004 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923	55.7923 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129	-118.8129 (71)
Water heating gains (Table 5)												
	129.7255	127.3059	120.7805	107.9465	97.2584	90.7638	85.4562	93.2572	102.6772	114.2497	123.7338	127.3160 (72)
Total internal gains												
	844.6002	838.8302	805.7911	750.3843	692.4717	646.7547	620.7364	631.8878	667.8215	721.9668	778.6754	821.4800 (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					11.4300	14.6401		0.6300	0.7000	0.7700		51.1401 (74)	
East					2.0700	27.3735		0.6300	0.7000	0.7700		17.3170 (76)	
South					7.7500	61.3950		0.6300	0.7000	0.7700		145.4140 (78)	
West					7.1600	27.3735		0.6300	0.7000	0.7700		59.8983 (80)	
South					6.3000	61.3950		0.6300	0.7000	0.7700		118.2075 (78)	
Solar gains	391.9769	558.5226	789.6798	1051.0848	1180.7541	1274.7613	1219.9347	1086.5773	926.9185	666.4650	452.1583	324.0942	(83)
Total gains	1236.5771	1397.3528	1595.4709	1801.4691	1873.2258	1921.5160	1840.6711	1718.4652	1594.7400	1388.4318	1230.8337	1145.5742	(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	44.6504	45.4886	45.7030	45.9195	45.4886	45.9195	45.9195	45.9195	45.9195	45.9195	45.9195	45.7030
alpha	3.9767	4.0326	4.0469	4.0613	4.0326	4.0613	4.0613	4.0613	4.0613	4.0613	4.0613	4.0469
util living area												
	0.9854	0.9757	0.9465	0.8704	0.7292	0.5111	0.3484	0.3614	0.6418	0.8856	0.9695	0.9881 (86)
MIT	19.6859	19.8709	20.2060	20.5859	20.8521	20.9741	20.9959	20.9954	20.9356	20.6359	20.1316	19.6954 (87)
Th 2	19.9622	19.9794	19.9837	19.9880	19.9794	19.9880	19.9880	19.9880	19.9880	19.9880	19.9880	19.9837 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

MIT 2	0.9816	0.9697	0.9329	0.8382	0.6654	0.4197	0.2433	0.2491	0.5489	0.8478	0.9603	0.9850 (89)
Living area fraction	18.2397	18.5177	18.9982	19.5214	19.8447	19.9729	19.9869	19.9868	19.9438	19.6000	18.9023	18.2683 (90)
MIT	18.4100	18.6771	19.1404	19.6468	19.9633	20.0908	20.1057	20.1056	fLA = Living area / (4) =			0.1178 (91)
Temperature adjustment									20.0606	19.7220	19.0471	18.4364 (92)
adjusted MIT	18.4100	18.6771	19.1404	19.6468	19.9633	20.0908	20.1057	20.1056	20.0606	19.7220	19.0471	0.0000
												18.4364 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9735	0.9590	0.9186	0.8256	0.6643	0.4293	0.2557	0.2624	0.5561	0.8358	0.9485	0.9780 (94)	
Useful gains	1203.8195	1340.0622	1465.5870	1487.2971	1244.4369	824.9928	470.5776	450.8608	886.7781	1160.4203	1167.4727	1120.3773 (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	2645.1518	2570.0913	2314.2562	1912.2126	1379.0711	841.8161	471.9747	452.3367	933.9866	1514.9739	2088.8413	2550.0057 (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	1072.3512	826.5795	631.4099	305.9392	100.1679	0.0000	0.0000	0.0000	0.0000	263.7879	663.3854	1063.6435 (98)	
Space heating												4927.2644 (98)	
Space heating per m2												(98) / (4) =	28.0229 (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													5438.4817 (211)
Space heating requirement	1072.3512	826.5795	631.4099	305.9392	100.1679	0.0000	0.0000	0.0000	0.0000	263.7879	663.3854	1063.6435 (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)	1183.6106	912.3394	696.9205	337.6812	110.5605	0.0000	0.0000	0.0000	0.0000	291.1566	732.2134	1173.9994 (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	186.4982	147.6122	123.1781	67.0008	36.2116	10.4111	5.2762	38.1375	69.7122	124.1764	161.7378	187.5136 (64)	
Efficiency of water heater (217)m	88.8375	88.7982	88.6618	88.4715	87.4891	79.9000	79.9000	79.9000	79.9000	86.8762	88.2826	79.9000 (216)	
Fuel for water heating, kWh/month	209.9319	166.2334	138.9303	75.7315	41.3899	13.0302	6.6035	47.7316	87.2493	142.9348	183.2046	211.1226 (219)	
Water heating fuel used												1324.0936 (219)	
Annual totals kWh/year													
Space heating fuel - main system												5438.4817 (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)													147.3927 (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													272.3927 (231)
Electricity for lighting (calculated in Appendix L)													551.6687 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.36 * 1246 * 1.00) =									-1355.6655				-1355.6655 (233)
Total delivered energy for all uses													6230.9712 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5438.4817	3.6300	197.4169 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1324.0936	3.6300	48.0646 (247)	
Mechanical ventilation fans	147.3927	19.4400	28.6531 (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	551.6687	19.4400	107.2444 (250)	
Additional standing charges			95.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1355.6655	19.4400	-263.5414 (252)	
Total energy cost			237.1376 (255)	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5438.4817	0.2160	1174.7121 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1324.0936	0.2160	286.0042 (264)
Space and water heating			1460.7163 (265)
Pumps and fans	272.3927	0.5190	141.3718 (267)
Energy for lighting	551.6687	0.5190	286.3161 (268)
Energy saving/generation technologies			
PV Unit	-1355.6655	0.5190	-703.5904 (269)
Total kg/year			1184.8137 (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	5438.4817	1.2200	6634.9477 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1324.0936	1.2200	1615.3942 (264)
Space and water heating			8250.3418 (265)
Pumps and fans	272.3927	3.0700	836.2456 (267)
Energy for lighting	551.6687	3.0700	1693.6229 (268)
Energy saving/generation technologies			
PV Unit	-1355.6655	3.0700	-4161.8931 (269)
Primary energy kWh/year			6618.3172 (272)
Primary energy kWh/m2/year			37.6404 (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	184.5 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	8.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1189.60 (P1)
Transmission heat loss coefficient	121.84 (37)
Summer heat loss coefficient	1311.44 (P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
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

Orientation	Z blinds	Solar access	Z overhangs	Z summer
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	11.4300	87.1704	0.6300	0.7000	0.9000	355.9091
East	2.0700	125.2818	0.6300	0.7000	0.9000	92.6364
South	7.7500	118.5567	0.6300	0.7000	0.9000	328.2096
West	7.1600	125.2818	0.6300	0.7000	0.9000	320.4236
South	6.3000	118.5567	0.6300	0.7000	0.9000	266.8027
total:						1363.9815

Solar gains	Jun 1460	Jul 1364	Aug 1238	(P3)
Internal gains	670	644	654	
Total summer gains	2130	2008	1892	(P5)
Summer gain/loss ratio	1.62	1.53	1.44	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 184.5)	0.71	0.71	0.71	
Threshold temperature	17.73	19.54	19.45	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Assessment of likelihood of high internal temperature:

Not significant

PREDICTED ENERGY ASSESSMENT

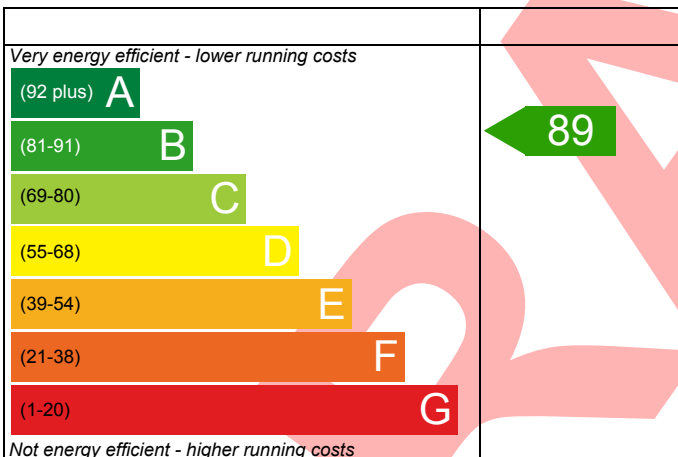
Plot 5, Long Copse Lane,
Emsworth,
Hampshire,
PO10 7UR

Dwelling type: House, Detached
Date of assessment: 10/05/2022
Produced by: Scott Spearing
Total floor area: 175.83 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

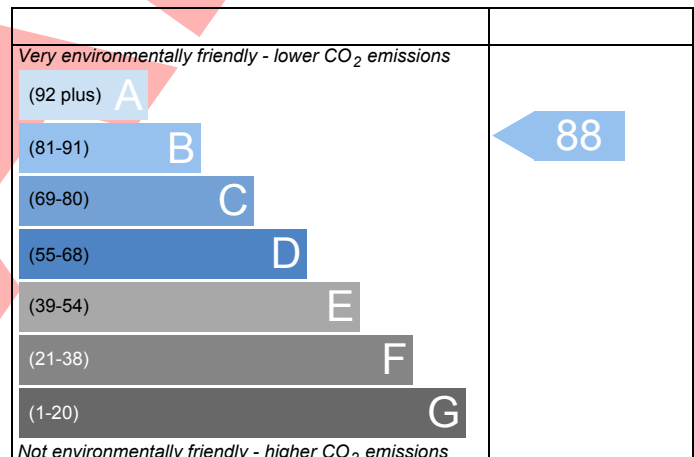


England

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.