



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client: Shorewood Homes Ltd

Project: Tree House, Larg Drive
Winchester, Hampshire, SO22 6NU

Contact: Scott Spearing
Scott Spearing
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Report Issue Date: 01/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	SAP-1425 - Plot 6		Issued on Date	01/03/2023	
Assessment Reference	REV-	Prop Type Ref			
Property	Tree House, Larg Drive, Winchester, Hampshire, SO22 6NU				
SAP Rating	92 A	DER	9.05	TER	15.47
Environmental	91 B	% DER<TER	41.50		
CO₂ Emissions (t/year)	1.40	DFEE	52.81	TFEE	61.88
General Requirements Compliance	Pass	% DFEE<TFEE	14.66		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client	Shorewood Homes Ltd, SHOREWOOD HOMES				

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)	15.47	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.05	kgCO ₂ /m ²	Pass
	-6.42 (-41.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	61.88	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	52.81	kWh/m ² /yr	
	-9.1 (-14.7%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	Pass
Floor	0.13 (max. 0.25)	0.15 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.15 (max. 0.35)	Pass
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	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 Worcester Greenstar 18i System ErP Efficiency: 89.7% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Secondary heating system

Room heaters - Wood Logs
Closed room heater
Efficiency: 65%
Minimum: 65%

Pass

5 Cylinder insulation

Hot water storage

Measured cylinder loss: 1.95 kWh/day
Permitted by DBSCG 2.30

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

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Not significant

Pass

Based on:

Overshading

Average

Windows facing North East

4.72 m², No overhang

Windows facing South East

10.36 m², No overhang

Windows facing South West

3.03 m², No overhang

Windows facing North West

12.94 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

Floor U-value

0.12

W/m²K

Secondary heating (wood logs)

N/A

Secondary heating fuel:

wood logs

Photovoltaic array

3.30

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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Environmental	91 B	% DER<TER	41.50		
CO ₂ Emissions (t/year)	1.40	DFEE	52.81	TREE	61.88
General Requirements Compliance	Pass	% DFEE<TFEE	14.66		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client	Shorewood Homes Ltd, SHOREWOOD HOMES				

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

Orientation	North West
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	2023
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:	49.60 m	112.22 m ²	2.53 m
1st Storey:	50.77 m	123.02 m ²	2.68 m

7.0 Living Area m²

8.0 Thermal Mass Parameter
 Thermal Mass
 kJ/m²K

9.0 External Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
External Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.18	60.00	237.65	204.63
Dormer Walls	Cavity Wall	Cavity wall : plasterboard on dabs, AAC block, filled cavity, any outside structure	0.17	60.00	9.24	6.78

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall Masonry	Dense block, plasterboard on dabs	75.00	115.13
Internal Wall Timber	Plasterboard on timber frame	9.00	180.10

10.0 External Roofs

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Gross Area (m ²)	Nett Area (m ²)
Bay Roof	External Flat Roof	Plasterboard, insulated flat roof	0.15	9.00	2.31	2.31
Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	11.50	11.50
Pitched Cold Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	98.41	98.41
Pitched Sloping Roof	External Slope Roof	Plasterboard, insulated slope	0.13	9.00	18.46	18.46
Dormer Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.13	9.00	3.07	3.07
Over Garage Flat Roof	External Flat Roof	Plasterboard, insulated flat roof	0.14	9.00	7.51	7.51

10.2 Internal Ceilings

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Ceilings	Plasterboard ceiling, carpeted chipboard floor	9.00	98.41

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Ground Floor	Ground Floor - Solid	Suspended concrete floor, carpeted	0.12	75.00	87.63
Exposed Floor	Exposed Floor - Timber	Timber exposed floor, insulation between joists	0.15	20.00	24.59

11.2 Internal Floors

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Floors	Plasterboard ceiling, carpeted chipboard floor	18.00	98.41

12.0 Opening Types

Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m ² K)
Front Door	Manufacturer	Solid Door							1.40
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Garage Door	Manufacturer	Solid Door							1.40
Bifold Door	Manufacturer	Window	Double Low-E Soft 0.05			0.63		0.70	1.40

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m ²)	Curtain Closed
Front Door	Solid Door	[1] External Walls	North West							2.33	
Front Elevation	Window	[1] External Walls	North West	None	0.00					11.71	
Side Elevation	Window	[1] External Walls	North East	None	0.00					4.72	
Rear Elevation	Window	[1] External Walls	South East	None	0.00					5.83	
Side Elevation	Window	[1] External Walls	South West	None	0.00					3.03	
Front Dormer	Window	[2] Dormer Walls	North West	None	0.00					1.23	
Rear Dormer	Window	[2] Dormer Walls	South East	None	0.00					1.23	
Garage Door	Solid Door	[1] External Walls	North East							2.10	
Rear Bifold Door	Window	[1] External Walls	South East	None	0.00					3.30	

14.0 Conservatory

15.0 Draught Proofing

 %

16.0 Draught Lobby

17.0 Thermal Bridging

17.1 List of Bridges

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Source Type	Bridge Type	Length	Psi	Imported
Table K1 - Approved	E2 Other lintels (including other steel lintels)	21.54	0.300	No
Table K1 - Approved	E3 Sill	19.54	0.040	No
Table K1 - Approved	E4 Jamb	62.36	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	49.60	0.160	Yes
Table K1 - Default	E20 Exposed floor (normal)	14.19	0.320	No
Table K1 - Default	E21 Exposed floor (inverted)	6.14	0.320	No
Table K1 - Approved	E6 Intermediate floor within a dwelling	36.58	0.070	No
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	36.58	0.060	No
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	12.94	0.240	No
Table K1 - Approved	E11 Eaves (insulation at rafter level)	6.10	0.040	No
Table K1 - Approved	E12 Gable (insulation at ceiling level)	1.96	0.240	No
Table K1 - Approved	E13 Gable (insulation at rafter level)	5.66	0.040	No
Table K1 - Default	E14 Flat roof	4.30	0.080	No
Table K1 - Default	E15 Flat roof with parapet	9.25	0.560	No
Table K1 - Approved	E16 Corner (normal)	42.81	0.090	No
Table K1 - Approved	E17 Corner (inverted – internal area greater than external area)	12.50	-0.090	No
Table K1 - Default	R6 Flat ceiling	7.30	0.060	No

Y-value W/m²K

18.0 Pressure Testing

Designed AP₅₀ m³/(h.m²) @ 50 Pa

Property Tested ?

As Built AP₅₀ m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather

Cross ventilation possible

Night Ventilation

Air change rate

Mechanical Ventilation

Mechanical Ventilation System Present

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0	0	0	0
Number of open flues	0	0	0	0
Number of intermittent fans				6
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System

22.0 Lighting

Internal

Total number of light fittings

Total number of L.E.L. fittings

Percentage of L.E.L. fittings %

External

External lights fitted

23.0 Electricity Tariff

24.0 Main Heating 1

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Percentage of Heat	100	%
Database Ref. No.	17485	
Fuel Type	Mains gas	
Main Heating	BGB	
SAP Code	102	
In Winter	90.7	
In Summer	80.0	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	No	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	in unheated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Normal (> 45°C)	
25.0 Main Heating 2	None	
Community Heating	None	
27.0 Secondary Heating	RWM	
Secondary Heating	SAP table	
Description	Wood Logs RWM Closed room heater	
SHS efficiency	65.00	%
SAP Code	633	
HETAS Approved System	Yes	
Smoke Control Area	Unknown	
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	210.00	L
Loss	1.95	kWh/day

SUMMARY FOR INPUT DATA

Calculation Type: New Build (As Designed)

Pipes insulation

31.0 Thermal Store

32.0 Photovoltaic Unit

PV Cells kWp	Orientation	Elevation	Overshading	Connected to Dwelling
3.30	South East	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

None

FULL SAP CALCULATION PRINTOUT

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Detached House, total floor area 235 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) 15.47 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.05 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 61.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 52.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.13 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.15 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Worcester Greenstar 18i System ErP
Boiler system with radiators or underfloor - Mains gas
Data from database

Efficiency: 89.7% SEDBUK2009
Minimum: 88.0%

OK

Secondary heating system:

Room heaters - Wood Logs

Closed room heater

Efficiency: 65%
Minimum: 65%

OK

5 Cylinder insulation

Hot water storage Permitted by DBSCG 2.30
Measured cylinder loss: 1.95 kWh/day
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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North East: 4.72 m², No overhang
Windows facing South East: 10.36 m², No overhang
Windows facing South West: 3.03 m², No overhang
Windows facing North West: 12.94 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs
Photovoltaic array 3.30 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	112.2200 (1b)	2.5300 (2b)	283.9166 (1b) - (3b)
First floor	123.0200 (1c)	2.6800 (2c)	329.6936 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.2400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 613.6102 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				6 * 10 =	60.0000 (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) =				60.0000 / (5) =	0.0978 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3478 (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) =		0.3478 (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												
Effective ac	0.4434	0.4347	0.4260	0.3826	0.3739	0.3304	0.3304	0.3217	0.3478	0.3739	0.3913	0.4086 (22b)
	0.5983	0.5945	0.5908	0.5732	0.5699	0.5546	0.5546	0.5517	0.5605	0.5699	0.5765	0.5835 (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			2.3300	1.4000	3.2620		(26)					
Windows (Uw = 1.40)			27.7500	1.3258	36.7898		(27)					
Garage Door			2.1000	1.4000	2.9400		(26)					
Bifold Door (Uw = 1.40)			3.3000	1.3258	4.3750		(27)					
Ground Floor			87.6300	0.1200	10.5156	75.0000	6572.2500 (28a)					
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)					
External Walls	237.6500	33.0200	204.6300	0.1800	36.8334	60.0000	12277.8000 (29a)					
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	60.0000	406.8000 (29a)					
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)					
Flat Roof	11.5000		11.5000	0.1400	1.6100	9.0000	103.5000 (30)					
Pitched Cold Roof	98.4100		98.4100	0.1000	9.8410	9.0000	885.6900 (30)					
Pitched Sloping Roof	18.4600		18.4600	0.1300	2.3998	9.0000	166.1400 (30)					
Dormer Flat Roof	3.0700		3.0700	0.1300	0.3991	9.0000	27.6300 (30)					
Over Garage Flat Roof	7.5100		7.5100	0.1400	1.0514	9.0000	67.5900 (30)					
Total net area of external elements Aum(A, m ²)			500.3700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		115.2047		(33)					
Internal Wall Masonry			115.1300			75.0000	8634.7500 (32c)					
Internal Wall Timber			180.1000			9.0000	1620.9000 (32c)					
Internal Floors			98.4100			18.0000	1771.3800 (32d)					
Internal Ceilings			98.4100			18.0000	1771.3800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	34818.4000 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							148.0122 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							42.2949 (36)					
Total fabric heat loss						(33) + (36) =	157.4996 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	121.1529	120.3799	119.6222	116.0632	115.3973	112.2976	112.2976	111.7236	113.4916	115.3973	116.7444	118.1527 (38)
Average = Sum(39)m / 12 =	278.6525	277.8795	277.1218	273.5628	272.8969	269.7972	269.7972	269.2232	270.9912	272.8969	274.2440	275.6522 (39)
												273.5596 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1845	1.1813	1.1780	1.1629	1.1601	1.1469	1.1469	1.1445	1.1520	1.1601	1.1658	1.1718 (40)
Days in month												1.1629 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Assumed occupancy												3.0477 (42)
Average daily hot water use (litres/day)												106.5839 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	117.2423	112.9789	108.7155	104.4522	100.1888	95.9255	95.9255	100.1888	104.4522	108.7155	112.9789	117.2423 (44)
Energy content	173.8669	152.0651	156.9175	136.8045	131.2672	113.2736	104.9646	120.4485	121.8870	142.0476	155.0560	168.3808 (45)
Energy content (annual)	Total = Sum (45)m =											1676.9793 (45)
Distribution loss (46)m = 0.15 x (45)m	26.0800	22.8098	23.5376	20.5207	19.6901	16.9910	15.7447	18.0673	18.2831	21.3071	23.2584	25.2571 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0530 (55)
Total storage loss	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (56)
If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (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	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862 (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	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862 (64)
	Total per year (kWh/year) = Sum(64)m =											2335.2203 (64)
Heat gains from water heating, kWh/month	102.5351	90.9578	96.8994	88.7691	88.3707	80.9451	79.6251	84.7734	83.8090	91.9551	94.8377	100.7109 (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	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0857	34.7155	28.2326	21.3739	15.9772	13.4886	14.5750	18.9451	25.4281	32.2868	37.6834	40.1720 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.4160	407.6022	397.0532	374.5954	346.2465	319.6026	301.8028	297.6166	308.1657	330.6235	358.9723	385.6163 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387 (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)	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097 (71)
Water heating gains (Table 5)	137.8159	135.3539	130.2411	123.2904	118.7778	112.4237	107.0229	113.9428	116.4014	123.5956	131.7191	135.3642 (72)
Total internal gains	649.0338	646.3878	624.2430	587.9758	549.7177	514.2311	492.1169	499.2206	518.7113	555.2219	597.0909	629.8685 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	4.7200	11.2829	0.6300	0.7000	0.7700	16.2756 (75)						
Southeast	7.0600	36.7938	0.6300	0.7000	0.7700	79.3874 (77)						
Southwest	3.0300	36.7938	0.6300	0.7000	0.7700	34.0714 (79)						
Northwest	12.9400	11.2829	0.6300	0.7000	0.7700	44.6199 (81)						
Southeast	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074 (77)						
Solar gains	211.4616	380.4244	574.2398	801.5649	980.0165	1009.0853	957.8195	819.1590	652.0917	434.9360	256.9658	178.5836 (83)
Total gains	860.4954	1026.8121	1198.4828	1389.5407	1529.7342	1523.3164	1449.9364	1318.3797	1170.8031	990.1580	854.0567	808.4521 (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	34.7091	34.8057	34.9008	35.3549	35.4411	35.8483	35.8483	35.9248	35.6904	35.4411	35.2671	35.0869
alpha	3.3139	3.3204	3.3267	3.3570	3.3627	3.3899	3.3899	3.3950	3.3794	3.3627	3.3511	3.3391
util living area	0.9970	0.9942	0.9874	0.9678	0.9187	0.8180	0.6898	0.7477	0.9118	0.9809	0.9948	0.9976 (86)
MIT	19.2566	19.4054	19.6754	20.0541	20.4206	20.7078	20.8378	20.8087	20.5658	20.0970	19.6158	19.2388 (87)
Th 2	19.9324	19.9350	19.9376	19.9498	19.9521	19.9627	19.9627	19.9647	19.9586	19.9521	19.9475	19.9426 (88)
util rest of house	0.9963	0.9928	0.9843	0.9588	0.8928	0.7519	0.5709	0.6384	0.8726	0.9742	0.9934	0.9970 (89)
MIT 2	17.5693	17.7886	18.1843	18.7417	19.2625	19.6509	19.7947	19.7718	19.4756	18.8098	18.1054	17.5504 (90)
Living area fraction	fLA = Living area / (4) =											0.0834 (91)
MIT	17.7100	17.9235	18.3087	18.8511	19.3591	19.7391	19.8817	19.8583	19.5665	18.9171	18.2314	17.6913 (92)
Temperature adjustment												0.0000
adjusted MIT	17.7100	17.9235	18.3087	18.8511	19.3591	19.7391	19.8817	19.8583	19.5665	18.9171	18.2314	17.6913 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9941	0.9890	0.9773	0.9459	0.8738	0.7346	0.5602	0.6249	0.8528	0.9644	0.9899	0.9952 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Useful gains	855.3856	1015.5428	1171.2575	1314.3654	1336.6984	1119.0351	812.2421	823.8284	998.4668	954.9124	845.4108	804.5729 (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												
Month fracti	3736.7429	3618.9574	3272.4464	2722.2586	2090.1430	1386.5041	885.3989	931.0449	1481.3750	2269.7228	3052.7231	3718.8980 (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	2143.7298	1749.4946	1563.2846	1013.6831	560.5628	0.0000	0.0000	0.0000	0.0000	978.2190	1589.2649	2168.2579 (98)
Space heating per m2												11766.4966 (98)
												(98) / (4) = 50.0191 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.7000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												11675.6858 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2143.7298	1749.4946	1563.2846	1013.6831	560.5628	0.0000	0.0000	0.0000	0.0000	978.2190	1589.2649	2168.2579 (98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)
Space heating fuel (main heating system)	2127.1851	1735.9924	1551.2195	1005.8597	556.2365	0.0000	0.0000	0.0000	0.0000	970.6693	1576.9993	2151.5238 (211)
Water heating requirement	329.8046	269.1530	240.5053	155.9512	86.2404	0.0000	0.0000	0.0000	0.0000	150.4952	244.5023	333.5781 (215)
Water heating requirement	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862 (64)
Efficiency of water heater (217)m	89.4271	89.3380	89.1336	88.6483	87.5319	80.0000	80.0000	80.0000	80.0000	88.5265	89.1783	89.0000 (216)
Fuel for water heating, kWh/month	256.9380	226.7347	238.7684	215.3528	213.8336	209.2195	201.0876	220.4423	219.9863	223.6088	234.5390	250.6930 (219)
Water heating fuel used												2711.2040 (219)
Annual totals kWh/year												
Space heating fuel - main system												11675.6858 (211)
Space heating fuel - secondary												1810.2303 (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)												690.2652 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 3.30 * 1029 * 1.00) =										-2717.0529		-2717.0529 (233)
Total delivered energy for all uses												14245.3323 (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	11675.6858	0.2160	2521.9481 (261)
Space heating - secondary	1810.2303	0.0190	34.3944 (263)
Water heating (other fuel)	2711.2040	0.2160	585.6201 (264)
Space and water heating			3141.9626 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	690.2652	0.5190	358.2476 (268)
Energy saving/generation technologies			
PV Unit	-2717.0529	0.5190	-1410.1505 (269)
Total CO2, kg/year			2128.9847 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0500 (273)

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

DER			9.0500 ZC1
Total Floor Area		TFA	235.2400
Assumed number of occupants		N	3.0477
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			10.1622 ZC2
CO2 emissions from cooking, equation (L16)			0.8168 ZC3
Total CO2 emissions			20.0290 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m ² /year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			20.0290 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	112.2200 (1b)	2.5300 (2b)	283.9166 (1b) - (3b)
First floor	123.0200 (1c)	2.6800 (2c)	329.6936 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.2400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 613.6102 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				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) =	0.0652 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3152 (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) =		0.3152 (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	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2915	0.3152	0.3388	0.3546	0.3703 (22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686 (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			4.4300	1.0000	4.4300		(26)
TER Opening Type (Uw = 1.40)			31.0500	1.3258	41.1648		(27)
Ground Floor			87.6300	0.1300	11.3919		(28a)
Exposed Floor			24.5900	0.1300	3.1967		(28b)
External Walls	237.6500	33.0200	204.6300	0.1800	36.8334		(29a)
Dormer Walls	9.2400	2.4600	6.7800	0.1800	1.2204		(29a)
Bay Roof	2.3100		2.3100	0.1300	0.3003		(30)
Flat Roof	11.5000		11.5000	0.1300	1.4950		(30)
Pitched Cold Roof	98.4100		98.4100	0.1300	12.7933		(30)
Pitched Sloping Roof	18.4600		18.4600	0.1300	2.3998		(30)
Dormer Flat Roof	3.0700		3.0700	0.1300	0.3991		(30)
Over Garage Flat Roof	7.5100		7.5100	0.1300	0.9763		(30)
Total net area of external elements Aum(A, m ²)			500.3700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	116.6010	(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)							34.4183 (36)
Total fabric heat loss							(33) + (36) = 151.0193 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	117.5964	116.9615	116.3391	113.4160	112.8691	110.3231	110.3231	109.8516	111.3038	112.8691	113.9755	115.1321 (38)
Average = Sum(39)m / 12 =	268.6156	267.9807	267.3584	264.4353	263.8883	261.3424	261.3424	260.8709	262.3231	263.8883	264.9947	266.1514 (39)
												264.4326 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1419	1.1392	1.1365	1.1241	1.1218	1.1110	1.1110	1.1090	1.1151	1.1218	1.1265	1.1314 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.0477 (42)
Average daily hot water use (litres/day)												106.5839 (43)
Daily hot water use	117.2423	112.9789	108.7155	104.4522	100.1888	95.9255	95.9255	100.1888	104.4522	108.7155	112.9789	117.2423 (44)
Energy conte	173.8669	152.0651	156.9175	136.8045	131.2672	113.2736	104.9646	120.4485	121.8870	142.0476	155.0560	168.3808 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1676.9793 (45)
Distribution loss (46)m = 0.15 x (45)m														
	26.0800	22.8098	23.5376	20.5207	19.6901	16.9910	15.7447	18.0673	18.2831	21.3071	23.2584	25.2571	(46)	
Water storage loss:														
Store volume														210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):														1.7016 (48)
Temperature factor from Table 2b														0.5400 (49)
Enter (49) or (54) in (55)														0.9188 (55)
Total storage loss	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(56)	
If cylinder contains dedicated solar storage	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842	(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	225.6135	198.8039	208.6641	186.8819	183.0138	163.3510	156.7112	172.1951	171.9644	193.7941	205.1334	220.1274	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
Output from w/h	225.6135	198.8039	208.6641	186.8819	183.0138	163.3510	156.7112	172.1951	171.9644	193.7941	205.1334	220.1274	(64)	
Heat gains from water heating, kWh/month	99.2080	87.9527	93.5724	85.5494	85.0436	77.7254	76.2980	81.4464	80.5893	88.6281	91.6180	97.3839	(65)	

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0857	34.7155	28.2326	21.3739	15.9772	13.4886	14.5750	18.9451	25.4281	32.2868	37.6834	40.1720	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.4160	407.6022	397.0532	374.5954	346.2465	319.6026	301.8028	297.6166	308.1657	330.6235	358.9723	385.6163	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	(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)	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	(71)
Water heating gains (Table 5)	133.3441	130.8820	125.7693	118.8186	114.3059	107.9519	102.5511	109.4710	111.9296	119.1238	127.2472	130.8923	(72)
Total internal gains	647.5619	644.9159	622.7712	586.5040	548.2458	512.7593	490.6450	497.7488	517.2395	553.7501	595.6191	628.3967	(73)

6. Solar gains

[Jan]	Area		Solar flux		Specific data		FF		Access		Gains		
	Jan	Feb	Table 6a	Table 6a	or Table 6b	or Table 6b	or Table 6c	or Table 6c	Table 6d	Table 6d	W	W	
Northeast		4.7200	11.2829	11.2829	0.6300	0.6300	0.7000	0.7000	0.7700	0.7700	16.2756	(75)	
Southeast		10.3600	36.7938	36.7938	0.6300	0.6300	0.7000	0.7000	0.7700	0.7700	116.4948	(77)	
Southwest		3.0300	36.7938	36.7938	0.6300	0.6300	0.7000	0.7000	0.7700	0.7700	34.0714	(79)	
Northwest		12.9400	11.2829	11.2829	0.6300	0.6300	0.7000	0.7000	0.7700	0.7700	44.6199	(81)	
Solar gains	211.4616	380.4244	574.2398	801.5649	980.0165	1009.0853	957.8195	819.1590	652.0917	434.9360	256.9658	178.5836	(83)
Total gains	859.0236	1025.3403	1197.0110	1388.0689	1528.2623	1521.8445	1448.4645	1316.9078	1169.3312	988.6862	852.5849	806.9802	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(85)
ta	60.8159	60.9600	61.1019	61.7774	61.9054	62.5085	62.5085	62.6214	62.2748	61.9054	61.6469	61.3790	
alpha	5.0544	5.0640	5.0735	5.1185	5.1270	5.1672	5.1672	5.1748	5.1517	5.1270	5.1098	5.0919	
util living area	0.9998	0.9995	0.9982	0.9921	0.9648	0.8747	0.7285	0.7967	0.9600	0.9966	0.9996	0.9999	(86)
MIT	19.5498	19.6840	19.9267	20.2689	20.6069	20.8627	20.9619	20.9394	20.7238	20.2941	19.8648	19.5320	(87)
Th 2	19.9668	19.9690	19.9711	19.9812	19.9831	19.9919	19.9919	19.9935	19.9885	19.9831	19.9793	19.9753	(88)
util rest of house	0.9997	0.9993	0.9975	0.9884	0.9459	0.8040	0.5923	0.6716	0.9293	0.9946	0.9994	0.9998	(89)
MIT 2	18.0053	18.2033	18.5598	19.0657	19.5480	19.8826	19.9751	19.9623	19.7190	19.1057	18.4754	17.9852	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.1341	18.3268	18.6738	19.1660	19.6364	19.9643	20.0574	20.0438	19.8028	19.2048	18.5913	18.1142	(92)
Temperature adjustment													
adjusted MIT	18.1341	18.3268	18.6738	19.1660	19.6364	19.9643	20.0574	20.0438	19.8028	19.2048	18.5913	18.1142	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(94)
Utilisation	0.9995	0.9988	0.9960	0.9840	0.9372	0.8016	0.6021	0.6789	0.9213	0.9920	0.9989	0.9997	
Useful gains	858.6209	1024.0683	1192.2692	1365.8053	1432.2166	1219.9420	872.1767	894.0655	1077.3551	980.7779	851.6661	806.7107	(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	3716.0544	3598.1295	3254.7772	2714.7004	2094.3104	1401.9290	903.5565	950.5548	1495.9738	2270.7070	3045.1230	3703.2943	(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	2125.9305	1729.7691	1534.5059	971.2045	492.5978	0.0000	0.0000	0.0000	0.0000	959.7072	1579.2890	2155.0582	(98)
Space heating												11548.0623 (98)	

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Calculation Type: New Build (As Designed)

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Space heating per m2 (98) / (4) = 49.0906 (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 %) 93.5000 (206)
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)
 Space heating requirement 12350.8688 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2125.9305	1729.7691	1534.5059	971.2045	492.5978	0.0000	0.0000	0.0000	0.0000	959.7072	1579.2890	2155.0582	(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)	2273.7225	1850.0204	1641.1828	1038.7213	526.8426	0.0000	0.0000	0.0000	0.0000	1026.4248	1689.0792	2304.8751	(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	225.6135	198.8039	208.6641	186.8819	183.0138	163.3510	156.7112	172.1951	171.9644	193.7941	205.1334	220.1274	(64)
Efficiency of water heater (217)m	89.3506	89.2662	89.0704	88.5833	87.3281	79.8000	79.8000	79.8000	79.8000	88.5062	89.1262	79.8000	(216)
Fuel for water heating, kWh/month	252.5037	222.7092	234.2688	210.9674	209.5704	204.7004	196.3800	215.7833	215.4942	218.9610	230.1606	246.2573	(219)
Water heating fuel used												2657.7563	(219)
Annual totals kWh/year													
Space heating fuel - main system												12350.8688	(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)												690.2652	(232)
Total delivered energy for all uses												15773.8904	(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	12350.8688	0.2160	2667.7877	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2657.7563	0.2160	574.0754	(264)
Space and water heating			3241.8630	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	690.2652	0.5190	358.2476	(268)
Total CO2, kg/m2/year			3639.0357	(272)
Emissions per m2 for space and water heating			13.7811	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			1.5229	(272b)
Emissions per m2 for pumps and fans			0.1655	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.7811 * 1.00) + 1.5229 + 0.1655, rounded to 2 d.p.			15.4700	(273)

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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	112.2200 (1b)	2.5300 (2b)	283.9166 (1b) - (3b)
First floor	123.0200 (1c)	2.6800 (2c)	329.6936 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.2400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 613.6102 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				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) =	0.0652 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3152 (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) =		0.3152 (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												
Effective ac	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2915	0.3152	0.3388	0.3546	0.3703 (22b)
	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686 (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			2.3300	1.4000	3.2620		(26)
Windows (Uw = 1.40)			27.7500	1.3258	36.7898		(27)
Garage Door			2.1000	1.4000	2.9400		(26)
Bifold Door (Uw = 1.40)			3.3000	1.3258	4.3750		(27)
Ground Floor			87.6300	0.1200	10.5156	75.0000	6572.2500 (28a)
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)
External Walls	237.6500	33.0200	204.6300	0.1800	36.8334	60.0000	12277.8000 (29a)
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	60.0000	406.8000 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	11.5000		11.5000	0.1400	1.6100	9.0000	103.5000 (30)
Pitched Cold Roof	98.4100		98.4100	0.1000	9.8410	9.0000	885.6900 (30)
Pitched Sloping Roof	18.4600		18.4600	0.1300	2.3998	9.0000	166.1400 (30)
Dormer Flat Roof	3.0700		3.0700	0.1300	0.3991	9.0000	27.6300 (30)
Over Garage Flat Roof	7.5100		7.5100	0.1400	1.0514	9.0000	67.5900 (30)
Total net area of external elements Aum(A, m ²)			500.3700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		115.2047		(33)
Internal Wall Masonry			115.1300			75.0000	8634.7500 (32c)
Internal Wall Timber			180.1000			9.0000	1620.9000 (32c)
Internal Floors			98.4100			18.0000	1771.3800 (32d)
Internal Ceilings			98.4100			9.0000	885.6900 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 33932.7100 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							144.2472 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							42.2949 (36)
Total fabric heat loss							(33) + (36) = 157.4996 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	117.5964	116.9615	116.3391	113.4160	112.8691	110.3231	110.3231	109.8516	111.3038	112.8691	113.9755	115.1321 (38)
Heat transfer coeff	275.0959	274.4610	273.8387	270.9156	270.3686	267.8227	267.8227	267.3512	268.8034	270.3686	271.4750	272.6317 (39)
Average = Sum(39)m / 12 =												270.9129 (39)
HLP	1.1694	1.1667	1.1641	1.1517	1.1493	1.1385	1.1385	1.1365	1.1427	1.1493	1.1540	1.1590 (40)
HLP (average)												1.1516 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Assumed occupancy												3.0477 (42)
Average daily hot water use (litres/day)												106.5839 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	117.2423	112.9789	108.7155	104.4522	100.1888	95.9255	95.9255	100.1888	104.4522	108.7155	112.9789	117.2423 (44)
Energy content (annual)	173.8669	152.0651	156.9175	136.8045	131.2672	113.2736	104.9646	120.4485	121.8870	142.0476	155.0560	168.3808 (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												
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	36.9467	32.3138	33.3450	29.0710	27.8943	24.0706	22.3050	25.5953	25.9010	30.1851	32.9494	35.7809 (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	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	39.0857	34.7155	28.2326	21.3739	15.9772	13.4886	14.5750	18.9451	25.4281	32.2868	37.6834	40.1720 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	403.4160	407.6022	397.0532	374.5954	346.2465	319.6026	301.8028	297.6166	308.1657	330.6235	358.9723	385.6163 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387 (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)	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097 (71)
Water heating gains (Table 5)	49.6596	48.0861	44.8185	40.3763	37.4923	33.4314	29.9798	34.4023	35.9736	40.5714	45.7631	48.0926 (72)
Total internal gains	560.8774	559.1200	538.8204	505.0618	468.4322	435.2388	415.0737	419.6801	438.2835	472.1977	511.1349	542.5970 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W						
Northeast	4.7200	11.2829	0.6300	0.7000	0.7700	16.2756 (75)						
Southeast	7.0600	36.7938	0.6300	0.7000	0.7700	79.3874 (77)						
Southwest	3.0300	36.7938	0.6300	0.7000	0.7700	34.0714 (79)						
Northwest	12.9400	11.2829	0.6300	0.7000	0.7700	44.6199 (81)						
Southeast	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074 (77)						
Solar gains	211.4616	380.4244	574.2398	801.5649	980.0165	1009.0853	957.8195	819.1590	652.0917	434.9360	256.9658	178.5836 (83)
Total gains	772.3390	939.5443	1113.0602	1306.6266	1448.4487	1444.3241	1372.8932	1238.8392	1090.3752	907.1338	768.1007	721.1806 (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	34.2635	34.3428	34.4208	34.7922	34.8626	35.1940	35.1940	35.2561	35.0656	34.8626	34.7205	34.5732
alpha	3.2842	3.2895	3.2947	3.3195	3.3242	3.3463	3.3463	3.3504	3.3377	3.3242	3.3147	3.3049
util living area	0.9976	0.9952	0.9891	0.9711	0.9254	0.8309	0.7080	0.7673	0.9223	0.9841	0.9959	0.9981 (86)
MIT	18.7187	18.9199	19.2853	19.7954	20.2956	20.6908	20.8758	20.8319	20.4896	19.8487	19.1974	18.6901 (87)
Th 2	19.9445	19.9467	19.9488	19.9589	19.9607	19.9695	19.9695	19.9711	19.9661	19.9607	19.9569	19.9530 (88)
util rest of house	0.9971	0.9941	0.9864	0.9631	0.9016	0.7682	0.5913	0.6618	0.8872	0.9786	0.9948	0.9977 (89)
MIT 2	17.8362	18.0386	18.4043	18.9171	19.4043	19.7719	19.9150	19.8899	19.5998	18.9750	18.3235	17.8137 (90)
Living area fraction												fLA = Living area / (4) = 0.0834 (91)
MIT	17.9098	18.1121	18.4778	18.9903	19.4786	19.8485	19.9951	19.9685	19.6740	19.0478	18.3964	17.8868 (92)
Temperature adjustment												
adjusted MIT	17.9098	18.1121	18.4778	18.9903	19.4786	19.8485	19.9951	19.9685	19.6740	19.0478	18.3964	17.8868 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9955	0.9913	0.9810	0.9530	0.8874	0.7594	0.5947	0.6614	0.8740	0.9715	0.9924	0.9965 (94)
Ext temp.	768.8992	931.3297	1091.9588	1245.2594	1285.4231	1096.7695	816.4573	819.4204	952.9930	881.2599	762.2347	718.6337 (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	3743.9991	3626.1980	3279.9827	2733.6301	2103.0907	1405.6674	909.2968	954.0347	1498.3176	2284.0306	3066.6927	3731.4629 (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	2213.4744	1810.9515	1627.8898	1071.6269	608.3447	0.0000	0.0000	0.0000	0.0000	1043.6614	1659.2098	2241.5449 (98)
												(98) / (4) = 52.1880 (99)

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Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

 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												
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2517.5333	1981.8879	2031.8692	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6385	0.7208	0.6714	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1607.4323	1428.5141	1364.1332	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1840.9112	1753.6875	1600.7166	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	168.1049	241.9290	176.0180	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												586.0519 (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 kWh	0.0000	0.0000	0.0000	0.0000	0.0000	42.0262	60.4822	44.0045	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling kWh												146.5130 (107)
Space cooling per m2												0.6228 (108)
Energy for space heating												52.1880 (99)
Energy for space cooling												0.6228 (108)
Total												52.8108 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.8 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	112.2200 (1b)	2.5300 (2b)	283.9166 (1b) - (3b)
First floor	123.0200 (1c)	2.6800 (2c)	329.6936 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.2400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 613.6102 (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				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) =	0.0652 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3152 (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) =		0.3152 (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	0.4019	0.3940	0.3861	0.3467	0.3388	0.2994	0.2994	0.2915	0.3152	0.3388	0.3546	0.3703 (22b)
Effective ac	0.5807	0.5776	0.5745	0.5601	0.5574	0.5448	0.5448	0.5425	0.5497	0.5574	0.5629	0.5686 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
TER Opaque door			4.4300	1.0000	4.4300		(26)
TER Opening Type (Uw = 1.40)			31.0500	1.3258	41.1648		(27)
Ground Floor			87.6300	0.1300	11.3919		(28a)
Exposed Floor			24.5900	0.1300	3.1967		(28b)
External Walls	237.6500	33.0200	204.6300	0.1800	36.8334		(29a)
Dormer Walls	9.2400	2.4600	6.7800	0.1800	1.2204		(29a)
Bay Roof	2.3100		2.3100	0.1300	0.3003		(30)
Flat Roof	11.5000		11.5000	0.1300	1.4950		(30)
Pitched Cold Roof	98.4100		98.4100	0.1300	12.7933		(30)
Pitched Sloping Roof	18.4600		18.4600	0.1300	2.3998		(30)
Dormer Flat Roof	3.0700		3.0700	0.1300	0.3991		(30)
Over Garage Flat Roof	7.5100		7.5100	0.1300	0.9763		(30)
Total net area of external elements Aum(A, m2)			500.3700				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	116.6010	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							34.4183 (36)
Total fabric heat loss							(33) + (36) = 151.0193 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	117.5964	116.9615	116.3391	113.4160	112.8691	110.3231	110.3231	109.8516	111.3038	112.8691	113.9755	115.1321 (38)
Average = Sum(39)m / 12 =	268.6156	267.9807	267.3584	264.4353	263.8883	261.3424	261.3424	260.8709	262.3231	263.8883	264.9947	266.1514 (39)
												264.4326 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1419	1.1392	1.1365	1.1241	1.1218	1.1110	1.1110	1.1090	1.1151	1.1218	1.1265	1.1314 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.0477 (42)
Average daily hot water use (litres/day)												106.5839 (43)
Daily hot water use	117.2423	112.9789	108.7155	104.4522	100.1888	95.9255	95.9255	100.1888	104.4522	108.7155	112.9789	117.2423 (44)
Energy conte	173.8669	152.0651	156.9175	136.8045	131.2672	113.2736	104.9646	120.4485	121.8870	142.0476	155.0560	168.3808 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)													Total = Sum(45)m =	1676.9793 (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	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	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage															
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	0.0000	0.0000	(57)
Heat gains from water heating, kWh/month															
	36.9467	32.3138	33.3450	29.0710	27.8943	24.0706	22.3050	25.5953	25.9010	30.1851	32.9494	35.7809	35.7809	35.7809	(65)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	152.3871	(66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	39.0857	34.7155	28.2326	21.3739	15.9772	13.4886	14.5750	18.9451	25.4281	32.2868	37.6834	40.1720	(67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	403.4160	407.6022	397.0532	374.5954	346.2465	319.6026	301.8028	297.6166	308.1657	330.6235	358.9723	385.6163	(68)
Pumps, fans	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	38.2387	(69)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (Table 5)	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	(71)
Total internal gains	49.6596	48.0861	44.8185	40.3763	37.4923	33.4314	29.9798	34.4023	35.9736	40.5714	45.7631	48.0926	(72)
	560.8774	559.1200	538.8204	505.0618	468.4322	435.2388	415.0737	419.6801	438.2835	472.1977	511.1349	542.5970	(73)

6. Solar gains

[Jan]	Area	Solar flux	g		FF	Access	Gains						
	m ²	Table 6a	Specific data	Table 6b	Specific data	factor	W						
		W/m ²	or Table 6c		or Table 6c	Table 6d							
Northeast	4.7200	11.2829	0.6300		0.7000	0.7700	16.2756 (75)						
Southeast	10.3600	36.7938	0.6300		0.7000	0.7700	116.4948 (77)						
Southwest	3.0300	36.7938	0.6300		0.7000	0.7700	34.0714 (79)						
Northwest	12.9400	11.2829	0.6300		0.7000	0.7700	44.6199 (81)						
Solar gains	211.4616	380.4244	574.2398	801.5649	980.0165	1009.0853	957.8195	819.1590	652.0917	434.9360	256.9658	178.5836	(83)
Total gains	772.3390	939.5443	1113.0602	1306.6266	1448.4487	1444.3241	1372.8932	1238.8392	1090.3752	907.1338	768.1007	721.1806	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.8159	60.9600	61.1019	61.7774	61.9054	62.5085	62.5085	62.6214	62.2748	61.9054	61.6469	61.3790	
alpha	5.0544	5.0640	5.0735	5.1185	5.1270	5.1672	5.1672	5.1748	5.1517	5.1270	5.1098	5.0919	
util living area	0.9999	0.9997	0.9987	0.9939	0.9714	0.8926	0.7557	0.8244	0.9694	0.9977	0.9997	0.9999	(86)
MIT	19.5152	19.6498	19.8934	20.2375	20.5798	20.8459	20.9548	20.9281	20.6975	20.2619	19.8310	19.4977	(87)
Th 2	19.9668	19.9690	19.9711	19.9812	19.9831	19.9919	19.9919	19.9935	19.9885	19.9831	19.9793	19.9753	(88)
util rest of house	0.9998	0.9995	0.9982	0.9911	0.9555	0.8273	0.6201	0.7037	0.9446	0.9963	0.9996	0.9999	(89)
MIT 2	18.5929	18.7293	18.9744	19.3252	19.6613	19.9058	19.9778	19.9671	19.7817	19.3521	18.9187	18.5822	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.6698	18.8060	19.0510	19.4013	19.7379	19.9842	20.0593	20.0473	19.8581	19.4280	18.9948	18.6586	(92)
Temperature adjustment													
adjusted MIT	18.6698	18.8060	19.0510	19.4013	19.7379	19.9842	20.0593	20.0473	19.8581	19.4280	18.9948	18.6586	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9998	0.9993	0.9975	0.9887	0.9503	0.8267	0.6304	0.7115	0.9400	0.9951	0.9994	0.9998	(94)
Ext temp.	772.1575	938.8888	1110.3025	1291.8875	1376.5187	1194.0568	865.4703	881.4149	1024.9889	902.7212	767.6732	721.0644	(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	3859.9658	3726.5487	3355.6157	2776.9167	2121.1161	1407.1143	904.0502	951.4683	1510.4748	2329.6061	3152.0549	3848.1673	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m ²	2297.3294	1873.3075	1670.5130	1069.2211	553.9805	0.0000	0.0000	0.0000	0.0000	1061.6024	1716.7548	2326.5646	(98)
												12569.2733 (98)	
												(98) / (4) =	53.4317 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	2456.6184	1933.9337	1982.6189	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6985	0.7943	0.7373	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1715.9277	1536.0714	1461.7371	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1840.9112	1753.6875	1600.7166	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	89.9882	161.9064	103.4007	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												355.2953 (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	22.4970	40.4766	25.8502	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												88.8238 (107)
Energy for space heating												0.3776 (108)
Energy for space cooling												53.4317 (99)
Total												0.3776 (108)
Target Fabric Energy Efficiency (TFEE)												53.8093 (109)
												61.9 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	112.2200 (1b)	2.5300 (2b)	283.9166 (1b) - (3b)
First floor	123.0200 (1c)	2.6800 (2c)	329.6936 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.2400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 613.6102 (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				6 * 10 =	60.0000 (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) =				60.0000 / (5) =	0.0978 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3478 (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) =		0.3478 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.1000	3.8000	3.9000	3.7000	3.6000	3.3000	3.3000	3.2000	3.2000	3.4000	3.3000	3.7000 (22)
Wind factor	1.0250	0.9500	0.9750	0.9250	0.9000	0.8250	0.8250	0.8000	0.8000	0.8500	0.8250	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3565	0.3304	0.3391	0.3217	0.3130	0.2869	0.2869	0.2782	0.2782	0.2956	0.2869	0.3217 (22b)
	0.5635	0.5546	0.5575	0.5517	0.5490	0.5412	0.5412	0.5387	0.5387	0.5437	0.5412	0.5517 (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			2.3300	1.4000	3.2620		(26)
Windows (Uw = 1.40)			27.7500	1.3258	36.7898		(27)
Garage Door			2.1000	1.4000	2.9400		(26)
Bifold Door (Uw = 1.40)			3.3000	1.3258	4.3750		(27)
Ground Floor			87.6300	0.1200	10.5156	75.0000	6572.2500 (28a)
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)
External Walls	237.6500	33.0200	204.6300	0.1800	36.8334	60.0000	12277.8000 (29a)
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	60.0000	406.8000 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	11.5000		11.5000	0.1400	1.6100	9.0000	103.5000 (30)
Pitched Cold Roof	98.4100		98.4100	0.1000	9.8410	9.0000	885.6900 (30)
Pitched Sloping Roof	18.4600		18.4600	0.1300	2.3998	9.0000	166.1400 (30)
Dormer Flat Roof	3.0700		3.0700	0.1300	0.3991	9.0000	27.6300 (30)
Over Garage Flat Roof	7.5100		7.5100	0.1400	1.0514	9.0000	67.5900 (30)
Total net area of external elements Aum(A, m2)			500.3700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		115.2047		(33)
Internal Wall Masonry			115.1300			75.0000	8634.7500 (32c)
Internal Wall Timber			180.1000			9.0000	1620.9000 (32c)
Internal Floors			98.4100			18.0000	1771.3800 (32d)
Internal Ceilings			98.4100			18.0000	1771.3800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	34818.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							148.0122 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							42.2949 (36)
Total fabric heat loss						(33) + (36) =	157.4996 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	114.1115	112.2976	112.8869	111.7236	111.1649	109.5805	109.5805	109.0831	109.0831	110.0933	109.5805	111.7236 (38)
Heat transfer coeff	271.6111	269.7972	270.3865	269.2232	268.6644	267.0801	267.0801	266.5826	266.5826	267.5929	267.0801	269.2232 (39)
Average = Sum(39)m / 12 =												268.4087 (39)
HLP	1.1546	1.1469	1.1494	1.1445	1.1421	1.1354	1.1354	1.1332	1.1332	1.1375	1.1354	1.1445 (40)
HLP (average)												1.1410 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Assumed occupancy 3.0477 (42)
 Average daily hot water use (litres/day) 106.5839 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	117.2423	112.9789	108.7155	104.4522	100.1888	95.9255	95.9255	100.1888	104.4522	108.7155	112.9789	117.2423 (44)
Energy content (annual)	173.8669	152.0651	156.9175	136.8045	131.2672	113.2736	104.9646	120.4485	121.8870	142.0476	155.0560	168.3808 (45)
Distribution loss (46)m = 0.15 x (45)m	26.0800	22.8098	23.5376	20.5207	19.6901	16.9910	15.7447	18.0673	18.2831	21.3071	23.2584	25.2571 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0530 (55)
Total storage loss	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (56)
If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (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	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862 (64)
RHI water heating demand												2335.2203 (64)
Heat gains from water heating, kWh/month	102.5351	90.9578	96.8994	88.7691	88.3707	80.9451	79.6251	84.7734	83.8090	91.9551	94.8377	100.7109 (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	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	97.7142	86.7889	70.5815	53.4347	39.9431	33.7216	36.4374	47.3627	63.5701	80.7169	94.2085	100.4300 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.1135	608.3615	592.6166	559.0976	516.7859	477.0188	450.4520	444.2039	459.9488	493.4678	535.7796	575.5466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342 (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)	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097 (71)
Water heating gains (Table 5)	137.8159	135.3539	130.2411	123.2904	118.7778	112.4237	107.0229	113.9428	116.4014	123.5956	131.7191	135.3642 (72)
Total internal gains	954.9326	947.7933	910.7283	853.1118	792.7958	740.4532	711.2014	722.7985	757.2094	815.0694	878.9962	928.6298 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	4.7200	14.6223	0.6300	0.7000	0.7700	21.0926 (75)						
Southeast	7.0600	45.2918	0.6300	0.7000	0.7700	97.7228 (77)						
Southwest	3.0300	45.2918	0.6300	0.7000	0.7700	41.9405 (79)						
Northwest	12.9400	14.6223	0.6300	0.7000	0.7700	57.8259 (81)						
Southeast	3.3000	45.2918	0.6300	0.7000	0.7700	45.6778 (77)						
Solar gains	264.2596	406.1862	616.1728	868.1742	1008.4978	1130.4401	1053.4406	923.2141	736.8643	495.8236	312.9611	211.0569 (83)
Total gains	1219.1922	1353.9795	1526.9011	1721.2860	1801.2935	1870.8933	1764.6420	1646.0126	1494.0737	1310.8930	1191.9573	1139.6867 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	35.6089	35.8483	35.7702	35.9248	35.9995	36.2130	36.2130	36.2806	36.2806	36.1436	36.2130	35.9248
alpha	3.3739	3.3899	3.3847	3.3950	3.4000	3.4142	3.4142	3.4187	3.4187	3.4096	3.4142	3.3950
util living area	0.9901	0.9848	0.9701	0.9316	0.8473	0.6726	0.4994	0.5527	0.8053	0.9465	0.9828	0.9919 (86)
MIT	19.5346	19.6724	19.9377	20.2838	20.6090	20.8276	20.8973	20.8871	20.7333	20.3438	19.9002	19.5143 (87)
Th 2	19.9565	19.9627	19.9607	19.9647	19.9666	19.9721	19.9721	19.9738	19.9738	19.9703	19.9721	19.9647 (88)
util rest of house	0.9879	0.9814	0.9629	0.9136	0.8028	0.5806	0.3659	0.4186	0.7338	0.9284	0.9781	0.9901 (89)
MIT 2	17.9917	18.1966	18.5796	19.0763	19.5220	19.7860	19.8469	19.8428	19.6916	19.1728	18.5361	17.9680 (90)
Living area fraction										fLA = Living area / (4) =		0.0834 (91)
MIT	18.1204	18.3197	18.6928	19.1770	19.6127	19.8729	19.9345	19.9299	19.7785	19.2704	18.6498	18.0970 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1204	18.3197	18.6928	19.1770	19.6127	19.8729	19.9345	19.9299	19.7785	19.2704	18.6498	18.0970 (93)

8. Space heating requirement

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Utilisation	0.9822	0.9737	0.9508	0.8960	0.7844	0.5706	0.3607	0.4124	0.7173	0.9118	0.9695	0.9853 (94)
Useful gains	1197.4868	1318.3430	1451.8524	1542.3552	1412.9080	1067.5443	636.4496	678.8195	1071.7503	1195.2827	1155.6320	1122.8971 (95)
Ext temp.	5.0000	5.6000	7.3000	9.7000	12.7000	15.5000	17.5000	17.3000	14.9000	11.5000	8.0000	5.0000 (96)
Heat loss rate W												
	3563.6496	3431.7388	3080.4673	2551.4332	1857.1903	1167.9093	650.2010	701.0869	1300.5142	2079.3146	2844.3610	3526.0192 (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												
	1760.4251	1420.2020	1211.6895	726.5361	330.5460	0.0000	0.0000	0.0000	0.0000	657.7197	1215.8849	1787.9228 (98)
Space heating												9110.9262 (98)
RHI space heating demand												9111 (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	112.2200 (1b)	2.5300 (2b)	283.9166 (1b) - (3b)
First floor	123.0200 (1c)	2.6800 (2c)	329.6936 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.2400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 613.6102 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				6 * 10 =	60.0000 (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) =				60.0000 / (5) =	0.0978 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.3478 (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) =		0.3478 (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												
Effective ac	0.4434	0.4347	0.4260	0.3826	0.3739	0.3304	0.3304	0.3217	0.3478	0.3739	0.3913	0.4086 (22b)
	0.5983	0.5945	0.5908	0.5732	0.5699	0.5546	0.5546	0.5517	0.5605	0.5699	0.5765	0.5835 (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			2.3300	1.4000	3.2620		(26)
Windows (Uw = 1.40)			27.7500	1.3258	36.7898		(27)
Garage Door			2.1000	1.4000	2.9400		(26)
Bifold Door (Uw = 1.40)			3.3000	1.3258	4.3750		(27)
Ground Floor			87.6300	0.1200	10.5156	75.0000	6572.2500 (28a)
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)
External Walls	237.6500	33.0200	204.6300	0.1800	36.8334	60.0000	12277.8000 (29a)
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	60.0000	406.8000 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	11.5000		11.5000	0.1400	1.6100	9.0000	103.5000 (30)
Pitched Cold Roof	98.4100		98.4100	0.1000	9.8410	9.0000	885.6900 (30)
Pitched Sloping Roof	18.4600		18.4600	0.1300	2.3998	9.0000	166.1400 (30)
Dormer Flat Roof	3.0700		3.0700	0.1300	0.3991	9.0000	27.6300 (30)
Over Garage Flat Roof	7.5100		7.5100	0.1400	1.0514	9.0000	67.5900 (30)
Total net area of external elements Aum(A, m ²)			500.3700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		115.2047		(33)
Internal Wall Masonry			115.1300			75.0000	8634.7500 (32c)
Internal Wall Timber			180.1000			9.0000	1620.9000 (32c)
Internal Floors			98.4100			18.0000	1771.3800 (32d)
Internal Ceilings			98.4100			18.0000	1771.3800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	34818.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							148.0122 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							42.2949 (36)
Total fabric heat loss						(33) + (36) =	157.4996 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	121.1529	120.3799	119.6222	116.0632	115.3973	112.2976	112.2976	111.7236	113.4916	115.3973	116.7444	118.1527 (38)
Heat transfer coeff	278.6525	277.8795	277.1218	273.5628	272.8969	269.7972	269.7972	269.2232	270.9912	272.8969	274.2440	275.6522 (39)
Average = Sum(39)m / 12 =												273.5596 (39)
HLP	1.1845	1.1813	1.1780	1.1629	1.1601	1.1469	1.1469	1.1445	1.1520	1.1601	1.1658	1.1718 (40)
HLP (average)												1.1629 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Assumed occupancy												3.0477 (42)
Average daily hot water use (litres/day)												106.5839 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	117.2423	112.9789	108.7155	104.4522	100.1888	95.9255	95.9255	100.1888	104.4522	108.7155	112.9789	117.2423 (44)
Energy content (annual)	173.8669	152.0651	156.9175	136.8045	131.2672	113.2736	104.9646	120.4485	121.8870	142.0476	155.0560	168.3808 (45)
Distribution loss (46)m = 0.15 x (45)m	26.0800	22.8098	23.5376	20.5207	19.6901	16.9910	15.7447	18.0673	18.2831	21.3071	23.2584	25.2571 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.9500 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0530 (55)
Total storage loss	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (56)
If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430 (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	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862 (64)
Heat gains from water heating, kWh/month	102.5351	90.9578	96.8994	88.7691	88.3707	80.9451	79.6251	84.7734	83.8090	91.9551	94.8377	100.7109 (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	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	97.7142	86.7889	70.5815	53.4347	39.9431	33.7216	36.4374	47.3627	63.5701	80.7169	94.2085	100.4300 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.1135	608.3615	592.6166	559.0976	516.7859	477.0188	450.4520	444.2039	459.9488	493.4678	535.7796	575.5466 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342 (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)	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097 (71)
Water heating gains (Table 5)	137.8159	135.3539	130.2411	123.2904	118.7778	112.4237	107.0229	113.9428	116.4014	123.5956	131.7191	135.3642 (72)
Total internal gains	954.9326	947.7933	910.7283	853.1118	792.7958	740.4532	711.2014	722.7985	757.2094	815.0694	878.9962	928.6298 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	4.7200	11.2829	0.6300	0.7000	0.7700	16.2756 (75)						
Southeast	7.0600	36.7938	0.6300	0.7000	0.7700	79.3874 (77)						
Southwest	3.0300	36.7938	0.6300	0.7000	0.7700	34.0714 (79)						
Northwest	12.9400	11.2829	0.6300	0.7000	0.7700	44.6199 (81)						
Southeast	3.3000	36.7938	0.6300	0.7000	0.7700	37.1074 (77)						
Solar gains	211.4616	380.4244	574.2398	801.5649	980.0165	1009.0853	957.8195	819.1590	652.0917	434.9360	256.9658	178.5836 (83)
Total gains	1166.3943	1328.2177	1484.9681	1654.6767	1772.8123	1749.5384	1669.0209	1541.9575	1409.3011	1250.0054	1135.9620	1107.2134 (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	34.7091	34.8057	34.9008	35.3549	35.4411	35.8483	35.8483	35.9248	35.6904	35.4411	35.2671	35.0869
alpha	3.3139	3.3204	3.3267	3.3570	3.3627	3.3899	3.3899	3.3950	3.3794	3.3627	3.3511	3.3391
util living area	0.9923	0.9875	0.9767	0.9487	0.8859	0.7671	0.6279	0.6817	0.8666	0.9635	0.9878	0.9936 (86)
MIT	19.3878	19.5329	19.7925	20.1532	20.4934	20.7503	20.8589	20.8377	20.6337	20.1997	19.7357	19.3679 (87)
Th 2	19.9324	19.9350	19.9376	19.9498	19.9521	19.9627	19.9627	19.9647	19.9586	19.9521	19.9475	19.9426 (88)
util rest of house	0.9907	0.9847	0.9712	0.9355	0.8531	0.6941	0.5098	0.5687	0.8153	0.9516	0.9846	0.9922 (89)
MIT 2	17.7606	17.9738	18.3530	18.8807	19.3572	19.6956	19.8097	19.7947	19.5579	18.9549	18.2795	17.7387 (90)
Living area fraction												fLA = Living area / (4) = 0.0834 (91)
MIT	17.8963	18.1038	18.4731	18.9868	19.4519	19.7836	19.8972	19.8817	19.6477	19.0587	18.4010	17.8746 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8963	18.1038	18.4731	18.9868	19.4519	19.7836	19.8972	19.8817	19.6477	19.0587	18.4010	17.8746 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9860	0.9779	0.9607	0.9194	0.8336	0.6794	0.5015	0.5583	0.7959	0.9374	0.9778	0.9881 (94)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Useful gains	1150.0185	1298.8231	1426.6152	1521.3044	1477.8772	1188.6564	837.0419	860.9510	1121.6898	1171.7701	1110.7324	1094.0679 (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	3788.6433	3669.0715	3318.0090	2759.3828	2115.4800	1398.5153	889.5774	937.3492	1503.3677	2308.3662	3099.2223	3769.4284 (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	1963.1368	1592.8069	1407.1969	891.4165	474.3765	0.0000	0.0000	0.0000	0.0000	845.6275	1431.7127	1990.4682 (98)
Space heating per m2												10596.7421 (98)
												(98) / (4) = 45.0465 (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)												0.1000 (201)
Fraction of space heat from main system(s)												0.9000 (202)
Efficiency of main space heating system 1 (in %)												90.7000 (206)
Efficiency of secondary/supplementary heating system, %												65.0000 (208)
Space heating requirement												10514.9591 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1963.1368	1592.8069	1407.1969	891.4165	474.3765	0.0000	0.0000	0.0000	0.0000	845.6275	1431.7127	1990.4682 (98)
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000 (210)
Space heating fuel (main heating system)	1947.9858	1580.5140	1396.3365	884.5367	470.7154	0.0000	0.0000	0.0000	0.0000	839.1012	1420.6631	1975.1062 (211)
Water heating requirement	302.0211	245.0472	216.4918	137.1410	72.9810	0.0000	0.0000	0.0000	0.0000	130.0965	220.2635	306.2259 (215)
Water heating requirement	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862 (64)
Efficiency of water heater (217)m	89.3251	89.2225	88.9877	88.4266	87.1474	80.0000	80.0000	80.0000	80.0000	88.2633	89.0369	89.3700 (217)
Fuel for water heating, kWh/month	257.2315	227.0282	239.1600	215.8926	214.7770	209.2195	201.0876	220.4423	219.9863	224.2756	234.9116	250.9637 (219)
Water heating fuel used												2714.9757 (219)
Annual totals kWh/year												
Space heating fuel - main system												10514.9591 (211)
Space heating fuel - secondary												1630.2680 (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)												690.2652 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 3.30 * 1029 * 1.00) =									-2717.0529			-2717.0529 (233)
Total delivered energy for all uses												12908.4151 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	10514.9591	3.4800	365.9206 (240)
Space heating - secondary	1630.2680	4.2300	68.9603 (242)
Water heating (other fuel)	2714.9757	3.4800	94.4812 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	690.2652	13.1900	91.0460 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-2717.0529	13.1900	-358.3793 (252)
Total energy cost			391.9213 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.5874 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	91.8061
SAP rating (Section 12)		92 (258)
SAP band		A

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	10514.9591	0.2160	2271.2312 (261)
Space heating - secondary	1630.2680	0.0190	30.9751 (263)
Water heating (other fuel)	2714.9757	0.2160	586.4348 (264)
Space and water heating			2888.6410 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	690.2652	0.5190	358.2476 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-2717.0529	0.5190	-1410.1505 (269)
Total kg/year			1875.6632 (272)
CO2 emissions per m2			7.9700 (273)
EI value			91.0313
EI rating			91 (274)
EI band			B

 Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.9070 = 4.115$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.9070 = 0.2554$, stars = 4
Water heating energy efficiency	$3.48 / 0.8581 = 4.055$, stars = 4
Water heating environmental impact	$0.216 / 0.8581 = 0.2517$, 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	112.2200 (1b)	2.5300 (2b)	283.9166 (1b) - (3b)
First floor	123.0200 (1c)	2.6800 (2c)	329.6936 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	235.2400		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 613.6102 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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				6 * 10 =	60.0000 (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) =				60.0000 / (5) =	0.0978 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate					0.3478 (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) =		0.3478 (21)							
Wind speed	Jan 4.1000	Feb 3.8000	Mar 3.9000	Apr 3.7000	May 3.6000	Jun 3.3000	Jul 3.3000	Aug 3.2000	Sep 3.2000	Oct 3.4000	Nov 3.3000	Dec 3.7000 (22)
Wind factor	1.0250	0.9500	0.9750	0.9250	0.9000	0.8250	0.8250	0.8000	0.8000	0.8500	0.8250	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3565	0.3304	0.3391	0.3217	0.3130	0.2869	0.2869	0.2782	0.2782	0.2956	0.2869	0.3217 (22b)
	0.5635	0.5546	0.5575	0.5517	0.5490	0.5412	0.5412	0.5387	0.5387	0.5437	0.5412	0.5517 (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			2.3300	1.4000	3.2620		(26)					
Windows (Uw = 1.40)			27.7500	1.3258	36.7898		(27)					
Garage Door			2.1000	1.4000	2.9400		(26)					
Bifold Door (Uw = 1.40)			3.3000	1.3258	4.3750		(27)					
Ground Floor			87.6300	0.1200	10.5156	75.0000	6572.2500 (28a)					
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)					
External Walls	237.6500	33.0200	204.6300	0.1800	36.8334	60.0000	12277.8000 (29a)					
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	60.0000	406.8000 (29a)					
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)					
Flat Roof	11.5000		11.5000	0.1400	1.6100	9.0000	103.5000 (30)					
Pitched Cold Roof	98.4100		98.4100	0.1000	9.8410	9.0000	885.6900 (30)					
Pitched Sloping Roof	18.4600		18.4600	0.1300	2.3998	9.0000	166.1400 (30)					
Dormer Flat Roof	3.0700		3.0700	0.1300	0.3991	9.0000	27.6300 (30)					
Over Garage Flat Roof	7.5100		7.5100	0.1400	1.0514	9.0000	67.5900 (30)					
Total net area of external elements Aum(A, m ²)			500.3700				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	115.2047			(33)					
Internal Wall Masonry			115.1300			75.0000	8634.7500 (32c)					
Internal Wall Timber			180.1000			9.0000	1620.9000 (32c)					
Internal Floors			98.4100			18.0000	1771.3800 (32d)					
Internal Ceilings			98.4100			18.0000	1771.3800 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	34818.4000 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							148.0122 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							42.2949 (36)					
Total fabric heat loss						(33) + (36) =	157.4996 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 114.1115	Feb 112.2976	Mar 112.8869	Apr 111.7236	May 111.1649	Jun 109.5805	Jul 109.5805	Aug 109.0831	Sep 109.0831	Oct 110.0933	Nov 109.5805	Dec 111.7236 (38)
Heat transfer coeff	271.6111	269.7972	270.3865	269.2232	268.6644	267.0801	267.0801	266.5826	266.5826	267.5929	267.0801	269.2232 (39)
Average = Sum(39)m / 12 =												268.4087 (39)
HLP	Jan 1.1546	Feb 1.1469	Mar 1.1494	Apr 1.1445	May 1.1421	Jun 1.1354	Jul 1.1354	Aug 1.1332	Sep 1.1332	Oct 1.1375	Nov 1.1354	Dec 1.1445 (40)
HLP (average)												1.1410 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Assumed occupancy 3.0477 (42)
Average daily hot water use (litres/day) 106.5839 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	117.2423	112.9789	108.7155	104.4522	100.1888	95.9255	95.9255	100.1888	104.4522	108.7155	112.9789	117.2423	(44)
Energy content (annual)	173.8669	152.0651	156.9175	136.8045	131.2672	113.2736	104.9646	120.4485	121.8870	142.0476	155.0560	168.3808	(45)
Distribution loss (46)m = 0.15 x (45)m	26.0800	22.8098	23.5376	20.5207	19.6901	16.9910	15.7447	18.0673	18.2831	21.3071	23.2584	25.2571	(46)
Water storage loss:													
Store volume													210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.9500 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0530 (55)
Total storage loss	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430	(56)
If cylinder contains dedicated solar storage	32.6430	29.4840	32.6430	31.5900	32.6430	31.5900	32.6430	32.6430	31.5900	32.6430	31.5900	32.6430	(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	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862	(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	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862	(64)
Total per year (kWh/year) = Sum(64)m =													2335.2203 (64)
Heat gains from water heating, kWh/month	102.5351	90.9578	96.8994	88.7691	88.3707	80.9451	79.6251	84.7734	83.8090	91.9551	94.8377	100.7109	(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	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	182.8645	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	97.7142	86.7889	70.5815	53.4347	39.9431	33.7216	36.4374	47.3627	63.5701	80.7169	94.2085	100.4300	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	602.1135	608.3615	592.6166	559.0976	516.7859	477.0188	450.4520	444.2039	459.9488	493.4678	535.7796	575.5466	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	56.3342	(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)	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	-121.9097	(71)
Water heating gains (Table 5)	137.8159	135.3539	130.2411	123.2904	118.7778	112.4237	107.0229	113.9428	116.4014	123.5956	131.7191	135.3642	(72)
Total internal gains	954.9326	947.7933	910.7283	853.1118	792.7958	740.4532	711.2014	722.7985	757.2094	815.0694	878.9962	928.6298	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W							
Northeast	4.7200	14.6223	0.6300	0.7000	0.7700	21.0926 (75)							
Southeast	7.0600	45.2918	0.6300	0.7000	0.7700	97.7228 (77)							
Southwest	3.0300	45.2918	0.6300	0.7000	0.7700	41.9405 (79)							
Northwest	12.9400	14.6223	0.6300	0.7000	0.7700	57.8259 (81)							
Southeast	3.3000	45.2918	0.6300	0.7000	0.7700	45.6778 (77)							
Solar gains	264.2596	406.1862	616.1728	868.1742	1008.4978	1130.4401	1053.4406	923.2141	736.8643	495.8236	312.9611	211.0569	(83)
Total gains	1219.1922	1353.9795	1526.9011	1721.2860	1801.2935	1870.8933	1764.6420	1646.0126	1494.0737	1310.8930	1191.9573	1139.6867	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)												
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.6089	35.8483	35.7702	35.9248	35.9995	36.2130	36.2130	36.2806	36.2806	36.1436	36.2130	35.9248	
alpha	3.3739	3.3899	3.3847	3.3950	3.4000	3.4142	3.4142	3.4187	3.4187	3.4096	3.4142	3.3950	
util living area	0.9901	0.9848	0.9701	0.9316	0.8473	0.6726	0.4994	0.5527	0.8053	0.9465	0.9828	0.9919	(86)
MIT	19.5346	19.6724	19.9377	20.2838	20.6090	20.8276	20.8973	20.8871	20.7333	20.3438	19.9002	19.5143	(87)
Th 2	19.9565	19.9627	19.9607	19.9647	19.9666	19.9721	19.9721	19.9738	19.9738	19.9703	19.9721	19.9647	(88)
util rest of house	0.9879	0.9814	0.9629	0.9136	0.8028	0.5806	0.3659	0.4186	0.7338	0.9284	0.9781	0.9901	(89)
MIT 2	17.9917	18.1966	18.5796	19.0763	19.5220	19.7860	19.8469	19.8428	19.6916	19.1728	18.5361	17.9680	(90)
Living area fraction	fLA = Living area / (4) =												
MIT	18.1204	18.3197	18.6928	19.1770	19.6127	19.8729	19.9345	19.9299	19.7785	19.2704	18.6498	18.0970	(92)
Temperature adjustment	0.0000												
adjusted MIT	18.1204	18.3197	18.6928	19.1770	19.6127	19.8729	19.9345	19.9299	19.7785	19.2704	18.6498	18.0970	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9822	0.9737	0.9508	0.8960	0.7844	0.5706	0.3607	0.4124	0.7173	0.9118	0.9695	0.9853	(94)

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Useful gains	1197.4868	1318.3430	1451.8524	1542.3552	1412.9080	1067.5443	636.4496	678.8195	1071.7503	1195.2827	1155.6320	1122.8971	(95)
Ext temp.	5.0000	5.6000	7.3000	9.7000	12.7000	15.5000	17.5000	17.3000	14.9000	11.5000	8.0000	5.0000	(96)
Heat loss rate W	3563.6496	3431.7388	3080.4673	2551.4332	1857.1903	1167.9093	650.2010	701.0869	1300.5142	2079.3146	2844.3610	3526.0192	(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	1760.4251	1420.2020	1211.6895	726.5361	330.5460	0.0000	0.0000	0.0000	0.0000	657.7197	1215.8849	1787.9228	(98)
Space heating per m2												38.7303	(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)													0.1000	(201)	
Fraction of space heat from main system(s)														0.9000	(202)
Efficiency of main space heating system 1 (in %)														90.7000	(206)
Efficiency of secondary/supplementary heating system, %														65.0000	(208)
Space heating requirement														9040.6104	(211)
Space heating requirement	1760.4251	1420.2020	1211.6895	726.5361	330.5460	0.0000	0.0000	0.0000	0.0000	657.7197	1215.8849	1787.9228	(98)		
Space heating efficiency (main heating system 1)	90.7000	90.7000	90.7000	90.7000	90.7000	0.0000	0.0000	0.0000	0.0000	90.7000	90.7000	90.7000	(210)		
Space heating fuel (main heating system)	1746.8386	1409.2412	1202.3380	720.9289	327.9950	0.0000	0.0000	0.0000	0.0000	652.6436	1206.5010	1774.1241	(211)		
Water heating requirement	270.8346	218.4926	186.4138	111.7748	50.8532	0.0000	0.0000	0.0000	0.0000	101.1876	187.0592	275.0650	(215)		
Water heating requirement	229.7723	202.5603	212.8229	190.9065	187.1726	167.3756	160.8700	176.3539	175.9890	197.9530	209.1580	224.2862	(64)		
Efficiency of water heater	89.1891	89.0703	88.7614	88.0390	86.2452	80.0000	80.0000	80.0000	80.0000	87.7585	88.7943	80.0000	(216)		
Fuel for water heating, kWh/month	257.6237	227.4161	239.7696	216.8431	217.0238	209.2195	201.0876	220.4423	219.9863	225.5656	235.5535	251.3296	(219)		
Water heating fuel used													(219)		
Annual totals kWh/year														2721.8606	
Space heating fuel - main system														9040.6104	(211)
Space heating fuel - secondary														1401.6810	(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)														690.2652	(232)
Energy saving/generation technologies (Appendices M ,N and Q)															
PV Unit 0 (0.80 * 3.30 * 1139 * 1.00) =										-3007.1937				-3007.1937	(233)
Total delivered energy for all uses														10922.2235	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	9040.6104	9.7400	880.5555 (240)
Space heating - secondary	1401.6810	10.2500	143.6723 (242)
Water heating (other fuel)	2721.8606	9.7400	265.1092 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	690.2652	36.8500	254.3627 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-3007.1937	36.8500	-1108.1509 (252)
Total energy cost			567.1863 (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	9040.6104	0.2160	1952.7718 (261)
Space heating - secondary	1401.6810	0.0190	26.6319 (263)
Water heating (other fuel)	2721.8606	0.2160	587.9219 (264)
Space and water heating			2567.3257 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	690.2652	0.5190	358.2476 (268)
Energy saving/generation technologies			
PV Unit	-3007.1937	0.5190	-1560.7335 (269)
Total kg/year			1403.7648 (272)

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

Energy Primary energy factor Primary energy

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

	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	9040.6104	1.2200	11029.5447 (261)
Space heating - secondary	1401.6810	1.0400	1457.7482 (263)
Water heating (other fuel)	2721.8606	1.2200	3320.6700 (264)
Space and water heating			15807.9628 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	690.2652	3.0700	2119.1142 (268)
Energy saving/generation technologies			
PV Unit	-3007.1937	3.0700	-9232.0845 (269)
Primary energy kWh/year			8925.2425 (272)
Primary energy kWh/m2/year			37.9410 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: A 92
 Current environmental impact rating: B 91

(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	SAP increase too small
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: (none) SAP change Cost change CO2 change

Measures omitted - SAP change or cost saving too small:
 N Solar water heating + 0.8 -£ 115 -272 kg (19.4%)

Recommended measures (none) Typical annual savings Energy efficiency Environmental impact

Total Savings £0 0.00 kg/m²

Potential energy efficiency rating: A 92
 Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 512 TEST (15 Feb 2023)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£282	£282	£0
Mains gas	£1250	£1250	£0
Wood	£144	£144	£0
Space heating	£1156	£1156	£0
Water heating	£265	£265	£0
Lighting	£254	£254	£0
Generated (PV)	-£1108	-£1108	£0
Total cost of fuels	£568	£568	£0
Total cost of uses	£567	£567	£0
Delivered energy	46 kWh/m ²	46 kWh/m ²	0 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	1.4 tonnes	0.0 tonnes
CO2 emissions per m ²	6 kg/m ²	6 kg/m ²	0 kg/m ²
Primary energy	38 kWh/m ²	38 kWh/m ²	0 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

No improvements selected / applicable

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

No improvements selected / applicable

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 West
Overshading	Average or unknown
Thermal mass parameter	148.0 (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	1619.93 (P1)
Transmission heat loss coefficient	157.50 (37)
Summer heat loss coefficient	1777.43 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.7200	106.0502	0.6300	0.7000	0.9000	178.8040
South East	7.0600	127.3119	0.6300	0.7000	0.9000	321.0681
South West	3.0300	127.3119	0.6300	0.7000	0.9000	137.7955
North West	12.9400	106.0502	0.6300	0.7000	0.9000	490.1956
South East	3.3000	127.3119	0.6300	0.7000	0.9000	150.0743

total: 1277.9376

	Jun	Jul	Aug	
Solar gains	1380	1278	1114	(P3)
Internal gains	740	711	723	
Total summer gains	2120	1989	1837	(P5)

	1.19	1.12	1.03	
Summer gain/loss ratio	1.19	1.12	1.03	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 148.0)	0.96	0.96	0.96	
Threshold temperature	17.56	19.38	19.30	(P7)

Likelihood of high internal temperature	Not significant	Not significant	Not significant
Assessment of likelihood of high internal temperature:	Not significant		

PREDICTED ENERGY ASSESSMENT

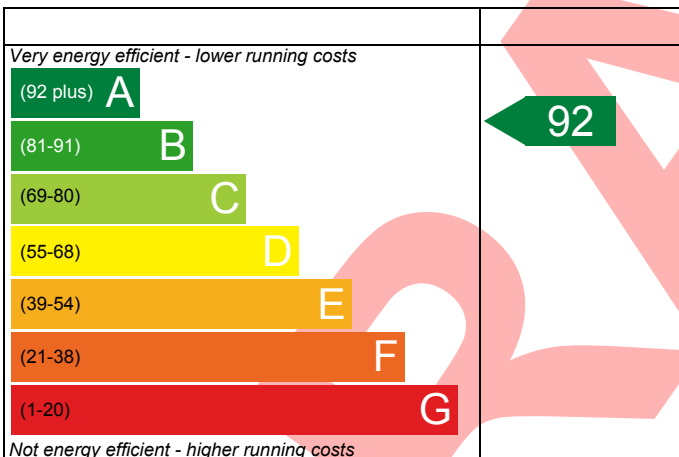
Tree House, Larg Drive,
Winchester,
Hampshire,
SO22 6NU

Dwelling type: House, Detached
Date of assessment: 01/03/2023
Produced by: Scott Spearing
Total floor area: 235.24 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.

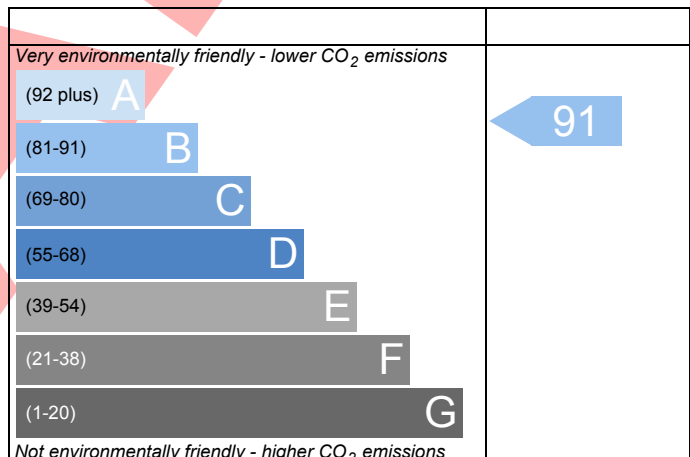
Energy Efficiency Rating



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.