



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
scott@beatsolutions.co.uk

Report Issue Date: 01/03/2023

EXCELLENCE
IN ENERGY
ASSESSMENT

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Designed)

Property Reference	SAP-1425 - Plot 5	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	9.07	
Environmental	92 A	TER	16.74	
CO₂ Emissions (t/year)	1.00	% DER<TER	45.81	
General Requirements Compliance	Pass	DFEE	55.10	
		TFEE	64.17	
		% DFEE<TFEE	14.14	
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)	16.74	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	9.07	kgCO ₂ /m ²	Pass
	-7.67 (-45.8%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	64.17	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	55.10	kWh/m ² /yr	
	-9.1 (-14.2%)	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
Party wall	0.00 (max. 0.20)	-	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

BASIC COMPLIANCE REPORT

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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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Secondary heating system	Room heaters - Wood Logs Closed room heater Efficiency: 65% Minimum: 65%	Pass
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5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.95 kWh/day Permitted by DBSCG 2.30	Pass
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Primary pipework insulated	Yes	Pass
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6 Controls

Space heating controls	Time and temperature zone control	Pass
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Hot water controls	Cylinderstat	Pass
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	Independent timer for DHW	Pass
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Boiler interlock	Yes	Pass
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7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
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Minimum	75	%	Pass
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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
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Based on:

Overshading	Average
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Windows facing North East	3.78 m ² , No overhang
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Windows facing South East	10.72 m ² , No overhang
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Windows facing South West	1.34 m ² , No overhang
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Windows facing North West	11.61 m ² , No overhang
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Air change rate	8.00 ach
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Blinds/curtains	None
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Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value	W/m ² K	
Filled Cavity with Edge Sealing	0.00		Pass

Air permeability and pressure testing

3 Air permeability

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

Calculation Type: New Build (As Designed)

10 Key features

Party wall U-value	0.00	W/m ² K
Roof U-value	0.10	W/m ² K
Floor U-value	0.12	W/m ² K
Secondary heating (wood logs)	N/A	
Secondary heating fuel:	wood logs	
Photovoltaic array	2.90	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	92 A	% DER<TER	45.81		
CO ₂ Emissions (t/year)	1.00	DFEE	55.10	TFEE	64.17
General Requirements Compliance	Pass	% DFEE<TFEE	14.14		
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, Semi-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:	42.63 m	79.94 m ²	2.52 m
1st Storey:	42.45 m	92.59 m ²	2.64 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	197.73	168.31
Dormer Walls	Timber Frame	Timber framed wall (one layer of plasterboard)	0.17	9.00	9.24	6.78

9.1 Party Walls

Description	Type	Construction	U-Value (W/m ² K)	Kappa (kJ/m ² K)	Area (m ²)
Party Walls	Filled Cavity with Edge Sealing	Single plasterboard on dabs on both sides, dense blocks, cavity or cavity fill	0.00	70.00	10.56

9.2 Internal Walls

Description	Construction	Kappa (kJ/m ² K)	Area (m ²)
Internal Wall Masonry	Dense block, plasterboard on dabs	75.00	40.05
Internal Wall Timber	Plasterboard on timber frame	9.00	163.94

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	9.64	7.84
Pitched Cold Roof	External Plane Roof	Plasterboard, insulated at ceiling level	0.10	9.00	67.99	67.99
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 Ceiling	Plasterboard ceiling, carpeted chipboard floor	9.00	67.99

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	55.35
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 Floor	Plasterboard ceiling, carpeted chipboard floor	18.00	67.99

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
Lantern Rooflight	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.63		0.70	1.40
Garage Door	Manufacturer	Solid Door							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					10.38	
Side Elevation	Window	[1] External Walls	North East	None	0.00					3.78	
Rear Elevation	Window	[1] External Walls	South East	None	0.00					9.49	
Side Elevation	Window	[1] External Walls	South West	None	0.00					1.34	
Lantern Rooflight	Roof Window	[2] Flat Roof	North	None						1.80	
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	

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)	19.00	0.300	No
Table K1 - Approved	E3 Sill	17.00	0.040	No
Table K1 - Approved	E4 Jamb	49.35	0.050	No
Table K1 - Approved	E5 Ground floor (normal)	42.63	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	34.30	0.070	No
Table K1 - Approved	E10 Eaves (insulation at ceiling level)	28.28	0.060	No
Table K1 - Default	E24 Eaves (insulation at ceiling level - inverted)	11.26	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				4
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
2.90	South West	30°	None Or Little	Yes

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£116	A 93	

FULL SAP CALCULATION PRINTOUT

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General Requirements Compliance	Pass	% DFEE<TFEE	14.14		
Assessor Details	Mr. Scott Spearing, Scott Spearing, Tel: 01489 565920, scott@beatsolutions.co.uk			Assessor ID	p775-0001
Client	Shorewood Homes Ltd, SHOREWOOD HOMES				

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

Semi-Detached House, total floor area 173 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.74 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 9.07 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 64.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 55.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	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 Measured cylinder loss: 1.95 kWh/day
Permitted by DBSCG 2.30 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

Cylinderstat OK

Independent timer for DHW OK

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Not significant OK

Based on:

Overshading: Average
Windows facing North East: 3.78 m², No overhang
Windows facing South East: 10.72 m², No overhang
Windows facing South West: 1.34 m², No overhang
Windows facing North West: 11.61 m², No overhang
Air change rate: 8.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.12 W/m²K
Secondary heating (wood logs)
Secondary heating fuel: wood logs
Photovoltaic array 2.90 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	79.9400 (1b)	x 2.5200 (2b)	= 201.4488 (1b) - (3b)
First floor	92.5900 (1c)	x 2.6400 (2c)	= 244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.8864 (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) =	0.0897 (8)							
Pressure test				Yes	5.0000							
Measured/design AP50					0.3397 (18)							
Infiltration rate					0 (19)							
Number of sides sheltered												
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)							
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3397 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3992 (22b)
	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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)			27.4500	1.3258	36.3920		(27)					
Garage Door			2.1000	1.4000	2.9400		(26)					
Lantern Rooflight (Uw = 1.40)			1.8000	1.3258	2.3864		(27a)					
Ground Floor			55.3500	0.1200	6.6420	75.0000	4151.2500 (28a)					
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)					
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958	60.0000	10098.6000 (29a)					
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	9.0000	61.0200 (29a)					
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)					
Flat Roof	9.6400	1.8000	7.8400	0.1400	1.0976	9.0000	70.5600 (30)					
Pitched Cold Roof	67.9900		67.9900	0.1000	6.7990	9.0000	611.9100 (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)			395.8900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8527		(33)					
Party Walls			10.5600	0.0000	0.0000	70.0000	739.2000 (32)					
Internal Wall Masonry			40.0500			75.0000	3003.7500 (32c)					
Internal Wall Timber			163.9400			9.0000	1475.4600 (32c)					
Internal Floor			67.9900			18.0000	1223.8200 (32d)					
Internal Ceiling			67.9900			18.0000	1223.8200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23433.3400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8218 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							38.6048 (36)					
Total fabric heat loss						(33) + (36) =	137.4575 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 87.3733	Feb 86.8373	Mar 86.3120	Apr 83.8445	May 83.3828	Jun 81.2337	Jul 81.2337	Aug 80.8358	Sep 82.0615	Oct 83.3828	Nov 84.3168	Dec 85.2932 (38)
Heat transfer coeff	224.8308	224.2948	223.7695	221.3020	220.8403	218.6912	218.6912	218.2933	219.5190	220.8403	221.7743	222.7507 (39)
Average = Sum(39)m / 12 =												221.2998 (39)
HLP	Jan 1.3031	Feb 1.3000	Mar 1.2970	Apr 1.2827	May 1.2800	Jun 1.2676	Jul 1.2676	Aug 1.2652	Sep 1.2724	Oct 1.2800	Nov 1.2854	Dec 1.2911 (40)
HLP (average)												1.2827 (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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Assumed occupancy												2.9659 (42)
Average daily hot water use (litres/day)												104.6413 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054
Energy content (annual)	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1646.4149 (45)
Water storage loss:	25.6047	22.3940	23.1086	20.1467	19.3312	16.6814	15.4577	17.7380	17.9498	20.9188	22.8345	24.7968
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
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
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
Total heat required for water heating calculated for each month	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173
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
Output from w/h	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173
Heat gains from water heating, kWh/month	101.4814	90.0363	95.9485	87.9401	87.5752	80.2586	78.9890	84.0435	83.0704	91.0943	93.8981	99.6905
												Total per year (kWh/year) = Sum(64)m = 2304.6559 (64)

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.5855	28.0540	22.8150	17.2724	12.9113	10.9003	11.7782	15.3097	20.5486	26.0912	30.4523	32.4634
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.1212	347.6921	338.6935	319.5367	295.3546	272.6268	257.4433	253.8724	262.8709	282.0278	306.2099	328.9376
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297
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
Losses e.g. evaporation (negative values) (Table 5)	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380
Water heating gains (Table 5)	136.3997	133.9825	128.9630	122.1390	117.7086	111.4703	106.1680	112.9617	115.3755	122.4386	130.4140	133.9926
Total internal gains	579.5957	577.2178	557.9608	526.4373	493.4637	462.4867	442.8786	449.6330	466.2843	498.0468	534.5654	562.8829

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	3.7800	11.2829	0.6300	0.7000	0.7700	13.0342 (75)						
Southeast	10.7200	36.7938	0.6300	0.7000	0.7700	120.5429 (77)						
Southwest	1.3400	36.7938	0.6300	0.7000	0.7700	15.0679 (79)						
Northwest	11.6100	11.2829	0.6300	0.7000	0.7700	40.0338 (81)						
North	1.8000	26.0000	0.6300	0.7000	1.0000	18.5749 (82)						
Solar gains	207.2537	377.5954	579.2625	818.3965	1005.4409	1036.3857	983.3440	838.5075	661.5300	434.4615	252.7796	174.3954
Total gains	786.8493	954.8133	1137.2233	1344.8338	1498.9046	1498.8723	1426.2227	1288.1405	1127.8143	932.5084	787.3450	737.2783

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Thl (C)												
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	28.9518	29.0210	29.0891	29.4135	29.4750	29.7646	29.7646	29.8189	29.6524	29.4750	29.3508	29.2222
util living area	2.9301	2.9347	2.9393	2.9609	2.9650	2.9843	2.9843	2.9879	2.9768	2.9650	2.9567	2.9481
MIT	0.9919	0.9851	0.9697	0.9307	0.8511	0.7228	0.5890	0.6498	0.8463	0.9578	0.9868	0.9933
Th 2	19.0873	19.2720	19.5950	20.0312	20.4299	20.7144	20.8343	20.8066	20.5637	20.0445	19.4906	19.0600
util rest of house	19.8384	19.8408	19.8432	19.8544	19.8565	19.8663	19.8663	19.8682	19.8626	19.8565	19.8523	19.8478
MIT 2	0.9901	0.9819	0.9629	0.9139	0.8119	0.6436	0.4669	0.5315	0.7897	0.9445	0.9834	0.9919
Living area fraction	17.2700	17.5405	18.0109	18.6436	19.1963	19.5650	19.6905	19.6706	19.3917	18.6737	17.8684	17.2363
MIT	17.4766	17.7374	18.1910	18.8014	19.3366	19.6957	19.8206	19.7998	19.5250	18.8296	18.0529	17.4437
Temperature adjustment												0.0000
adjusted MIT	17.4766	17.7374	18.1910	18.8014	19.3366	19.6957	19.8206	19.7998	19.5250	18.8296	18.0529	17.4437

8. Space heating requirement												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Utilisation	0.9848	0.9735	0.9492	0.8936	0.7900	0.6299	0.4614	0.5233	0.7685	0.9275	0.9756	0.9874 (94)
Useful gains	774.9060	929.4746	1079.5074	1201.7343	1184.1842	944.0808	658.1270	674.0384	866.7615	864.9333	768.0947	727.9630 (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	2962.5150	2879.3657	2616.0989	2191.1978	1686.4685	1114.3920	704.3169	742.1561	1190.8933	1817.4325	2429.0732	2950.0463 (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	1627.5812	1310.3268	1143.2241	712.4137	373.6995	0.0000	0.0000	0.0000	0.0000	708.6594	1195.9045	1653.2300 (98)
Space heating												8725.0392 (98)
Space heating per m2												(98) / (4) = 50.5711 (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												8657.7015 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1627.5812	1310.3268	1143.2241	712.4137	373.6995	0.0000	0.0000	0.0000	0.0000	708.6594	1195.9045	1653.2300 (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)	1615.0199	1300.2140	1134.4010	706.9155	370.8154	0.0000	0.0000	0.0000	0.0000	703.1901	1186.6748	1640.4708 (211)
Water heating requirement	250.3971	201.5887	175.8806	109.6021	57.4922	0.0000	0.0000	0.0000	0.0000	109.0245	183.9853	254.3431 (215)
Water heating												
Water heating requirement	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (64)
Efficiency of water heater	89.1034	88.9760	88.6896	88.0260	86.5932	80.0000	80.0000	80.0000	80.0000	87.9419	88.7896	89.1566 (217)
Fuel for water heating, kWh/month	254.3152	224.5424	236.7392	214.0425	213.3887	206.6389	198.6962	217.6982	217.2094	222.1512	232.3830	248.1223 (219)
Water heating fuel used												2685.9271 (219)
Annual totals kWh/year												
Space heating fuel - main system												8657.7015 (211)
Space heating fuel - secondary												1342.3137 (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)												557.8098 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.90 * 1029 * 1.00) =										-2387.7132		-2387.7132 (233)
Total delivered energy for all uses												10931.0390 (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	8657.7015	0.2160	1870.0635 (261)
Space heating - secondary	1342.3137	0.0190	25.5040 (263)
Water heating (other fuel)	2685.9271	0.2160	580.1603 (264)
Space and water heating			2475.7278 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	557.8098	0.5190	289.5033 (268)
Energy saving/generation technologies			
PV Unit	-2387.7132	0.5190	-1239.2231 (269)
Total CO2, kg/year			1564.9329 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			9.0700 (273)

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

DER		9.0700 ZC1
Total Floor Area		TFA 172.5300
Assumed number of occupants		N 2.9659
CO2 emission factor in Table 12 for electricity displaced from grid		EF 0.5190
CO2 emissions from appliances, equation (L14)		11.8193 ZC2
CO2 emissions from cooking, equation (L16)		1.1023 ZC3
Total CO2 emissions		21.9917 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		21.9917 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	79.9400 (1b)	2.5200 (2b)	201.4488 (1b) - (3b)
First floor	92.5900 (1c)	2.6400 (2c)	244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.8864 (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) =	0.0897 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3397 (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) =		0.3397 (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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3992 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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)			27.4500	1.3258	36.3920		(27)
TER Room Window (Uw = 1.70)			1.8000	1.5918	2.8652		(27a)
Ground Floor			55.3500	0.1300	7.1955		(28a)
Exposed Floor			24.5900	0.1300	3.1967		(28b)
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958		(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	9.6400	1.8000	7.8400	0.1300	1.0192		(30)
Pitched Cold Roof	67.9900		67.9900	0.1300	8.8387		(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)			395.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.5290		(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)							31.4974 (36)
Total fabric heat loss						(33) + (36) =	131.0264 (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	87.3733	86.8373	86.3120	83.8445	83.3828	81.2337	81.2337	80.8358	82.0615	83.3828	84.3168	85.2932 (38)
Heat transfer coeff	218.3997	217.8637	217.3384	214.8709	214.4093	212.2602	212.2602	211.8622	213.0880	214.4093	215.3432	216.3196 (39)
Average = Sum(39)m / 12 =												214.8687 (39)
HLP	1.2659	1.2628	1.2597	1.2454	1.2427	1.2303	1.2303	1.2280	1.2351	1.2427	1.2481	1.2538 (40)
HLP (average)												1.2454 (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												2.9659 (42)
Average daily hot water use (litres/day)												104.6413 (43)
Daily hot water use	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Energy content (annual)	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6047	22.3940	23.1086	20.1467	19.3312	16.6814	15.4577	17.7380	17.9498	20.9188	22.8345	24.7968 (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	222.4446	196.0324	205.8042	184.3885	180.6213	161.2864	154.7982	169.9998	169.7429	191.2052	202.3073	217.0585 (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	222.4446	196.0324	205.8042	184.3885	180.6213	161.2864	154.7982	169.9998	169.7429	191.2052	202.3073	217.0585 (64)
Heat gains from water heating, kWh/month	98.1544	87.0312	92.6214	84.7203	84.2481	77.0389	75.6619	80.7165	79.8507	87.7673	90.6783	96.3635 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.5855	28.0540	22.8150	17.2724	12.9113	10.9003	11.7782	15.3097	20.5486	26.0912	30.4523	32.4634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.1212	347.6921	338.6935	319.5367	295.3546	272.6268	257.4433	253.8724	262.8709	282.0278	306.2099	328.9376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380 (71)
Water heating gains (Table 5)	131.9279	129.5107	124.4912	117.6671	113.2367	106.9985	101.6961	108.4899	110.9037	117.9667	125.9421	129.5208 (72)
Total internal gains	578.1238	575.7460	556.4889	524.9655	491.9919	461.0148	441.4068	448.1612	464.8125	496.5750	533.0936	561.4110 (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	3.7800	11.2829	0.6300	0.7000	0.7700	13.0342 (75)						
Southeast	10.7200	36.7938	0.6300	0.7000	0.7700	120.5429 (77)						
Southwest	1.3400	36.7938	0.6300	0.7000	0.7700	15.0679 (79)						
Northwest	11.6100	11.2829	0.6300	0.7000	0.7700	40.0338 (81)						
North	1.8000	26.0000	0.6300	0.7000	1.0000	18.5749 (82)						
Solar gains	207.2537	377.5954	579.2625	818.3965	1005.4409	1036.3857	983.3440	838.5075	661.5300	434.4615	252.7796	174.3954 (83)
Total gains	785.3775	953.3414	1135.7514	1343.3619	1497.4328	1497.4005	1424.7508	1286.6687	1126.3425	931.0365	785.8732	735.8064 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)	0.9994	0.9983	0.9946	0.9780	0.9202	0.7840	0.6224	0.6963	0.9158	0.9905	0.9986	0.9996 (86)
tau	54.8593	54.9942	55.1272	55.7602	55.8803	56.4461	56.4461	56.5521	56.2268	55.8803	55.6379	55.3868
alpha	4.6573	4.6663	4.6751	4.7173	4.7254	4.7631	4.7631	4.7701	4.7485	4.7254	4.7092	4.6925
util living area	0.9994	0.9983	0.9946	0.9780	0.9202	0.7840	0.6224	0.6963	0.9158	0.9905	0.9986	0.9996 (86)
MIT	19.4741	19.6367	19.9210	20.3119	20.6702	20.9010	20.9747	20.9578	20.7648	20.3000	19.8189	19.4514 (87)
Th 2	19.8677	19.8701	19.8725	19.8838	19.8860	19.8959	19.8959	19.8977	19.8920	19.8860	19.8817	19.8772 (88)
util rest of house	0.9992	0.9977	0.9924	0.9686	0.8839	0.6916	0.4824	0.5576	0.8615	0.9851	0.9980	0.9994 (89)
MIT 2	17.8257	18.0653	18.4818	19.0540	19.5476	19.8263	19.8862	19.8791	19.6849	19.0441	18.3401	17.7990 (90)
Living area fraction									fLA = Living area / (4) =			0.1137 (91)
MIT	18.0131	18.2440	18.6455	19.1970	19.6753	19.9486	20.0100	20.0018	19.8077	19.1869	18.5083	17.9869 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0131	18.2440	18.6455	19.1970	19.6753	19.9486	20.0100	20.0018	19.8077	19.1869	18.5083	17.9869 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	784.2402	949.8101	1123.0969	1290.1534	1310.6752	1043.1607	709.3721	736.0707	964.3395	912.3050	783.3755	735.0269 (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	2994.9459	2907.1672	2639.6754	2212.5299	1709.9687	1135.2847	723.8112	763.0875	1216.2457	1841.1109	2456.6958	2982.3764 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Space heating	1644.7651	1315.3439	1128.3344	664.1111	297.0744	0.0000	0.0000	0.0000	0.0000	691.0316	1204.7906	1672.0280 (98)
Space heating per m2												8617.4790 (98)
											(98) / (4) =	49.9477 (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												9216.5550 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1644.7651	1315.3439	1128.3344	664.1111	297.0744	0.0000	0.0000	0.0000	0.0000	691.0316	1204.7906	1672.0280 (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)	1759.1070	1406.7849	1206.7748	710.2792	317.7266	0.0000	0.0000	0.0000	0.0000	739.0712	1288.5461	1788.2652 (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	222.4446	196.0324	205.8042	184.3885	180.6213	161.2864	154.7982	169.9998	169.7429	191.2052	202.3073	217.0585 (64)
Efficiency of water heater (217)m	89.0771	88.9530	88.6660	87.9377	86.1331	79.8000	79.8000	79.8000	79.8000	87.9443	88.7883	79.8000 (216)
Fuel for water heating, kWh/month	249.7214	220.3776	232.1116	209.6809	209.7001	202.1133	193.9827	213.0323	212.7103	217.4162	227.8535	243.5388 (219)
Water heating fuel used												2632.2389 (219)
Annual totals kWh/year												9216.5550 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
Electricity for pumps and fans:												30.0000 (230c)
central heating pump												45.0000 (230e)
main heating flue fan												75.0000 (231)
Total electricity for the above, kWh/year												557.8098 (232)
Electricity for lighting (calculated in Appendix L)												12481.6037 (238)
Total delivered energy for all uses												

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	9216.5550	0.2160	1990.7759 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2632.2389	0.2160	568.5636 (264)
Space and water heating			2559.3395 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	557.8098	0.5190	289.5033 (268)
Total CO2, kg/m2/year			2887.7678 (272)
Emissions per m2 for space and water heating			14.8342 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6780 (272b)
Emissions per m2 for pumps and fans			0.2256 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8342 * 1.00) + 1.6780 + 0.2256, rounded to 2 d.p.			16.7400 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	79.9400 (1b)	x 2.5200 (2b)	= 201.4488 (1b) - (3b)
First floor	92.5900 (1c)	x 2.6400 (2c)	= 244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.8864 (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) =	0.0897 (8)
Pressure test				Yes	
Measured/design AP50					5.0000
Infiltration rate					0.3397 (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) =		0.3397 (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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3992 (22b)
	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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)			27.4500	1.3258	36.3920		(27)
Garage Door			2.1000	1.4000	2.9400		(26)
Lantern Rooflight (Uw = 1.40)			1.8000	1.3258	2.3864		(27a)
Ground Floor			55.3500	0.1200	6.6420	75.0000	4151.2500 (28a)
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958	60.0000	10098.6000 (29a)
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	9.0000	61.0200 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	9.6400	1.8000	7.8400	0.1400	1.0976	9.0000	70.5600 (30)
Pitched Cold Roof	67.9900		67.9900	0.1000	6.7990	9.0000	611.9100 (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)			395.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8527		(33)
Party Walls			10.5600	0.0000	0.0000	70.0000	739.2000 (32)
Internal Wall Masonry			40.0500			75.0000	3003.7500 (32c)
Internal Wall Timber			163.9400			9.0000	1475.4600 (32c)
Internal Floor			67.9900			18.0000	1223.8200 (32d)
Internal Ceiling			67.9900			9.0000	611.9100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	22821.4300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							132.2751 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							38.6048 (36)
Total fabric heat loss						(33) + (36) =	137.4575 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	87.3733	86.8373	86.3120	83.8445	83.3828	81.2337	81.2337	80.8358	82.0615	83.3828	84.3168	85.2932 (38)
Heat transfer coeff	224.8308	224.2948	223.7695	221.3020	220.8403	218.6912	218.6912	218.2933	219.5190	220.8403	221.7743	222.7507 (39)
Average = Sum(39)m / 12 =												221.2998 (39)
HLP	1.3031	1.3000	1.2970	1.2827	1.2800	1.2676	1.2676	1.2652	1.2724	1.2800	1.2854	1.2911 (40)
HLP (average)												1.2827 (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											2.9659 (42)	
Average daily hot water use (litres/day)											104.6413 (43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054 (44)
Energy conte	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119 (45)
Energy content (annual)											Total = Sum(45)m =	1646.4149 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	36.2733	31.7249	32.7372	28.5411	27.3859	23.6319	21.8985	25.1288	25.4289	29.6350	32.3489	35.1288 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.5855	28.0540	22.8150	17.2724	12.9113	10.9003	11.7782	15.3097	20.5486	26.0912	30.4523	32.4634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.1212	347.6921	338.6935	319.5367	295.3546	272.6268	257.4433	253.8724	262.8709	282.0278	306.2099	328.9376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380 (71)
Water heating gains (Table 5)	48.7545	47.2096	44.0017	39.6404	36.8090	32.8221	29.4334	33.7753	35.3179	39.8319	44.9290	47.2161 (72)
Total internal gains	491.9504	490.4449	472.9994	443.9388	412.5641	383.8385	366.1441	370.4466	386.2268	415.4402	449.0804	476.1063 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W					
Northeast	3.7800	11.2829	0.6300	0.7000	0.7700	13.0342 (75)						
Southeast	10.7200	36.7938	0.6300	0.7000	0.7700	120.5429 (77)						
Southwest	1.3400	36.7938	0.6300	0.7000	0.7700	15.0679 (79)						
Northwest	11.6100	11.2829	0.6300	0.7000	0.7700	40.0338 (81)						
North	1.8000	26.0000	0.6300	0.7000	1.0000	18.5749 (82)						
Solar gains	207.2537	377.5954	579.2625	818.3965	1005.4409	1036.3857	983.3440	838.5075	661.5300	434.4615	252.7796	174.3954 (83)
Total gains	699.2041	868.0404	1052.2619	1262.3352	1418.0050	1420.2242	1349.4881	1208.9541	1047.7568	849.9017	701.8600	650.5017 (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	28.1958	28.2632	28.3295	28.6454	28.7053	28.9874	28.9874	29.0402	28.8781	28.7053	28.5844	28.4591
alpha	2.8797	2.8842	2.8886	2.9097	2.9137	2.9325	2.9325	2.9360	2.9252	2.9137	2.9056	2.8973
util living area	0.9936	0.9875	0.9735	0.9374	0.8626	0.7402	0.6099	0.6732	0.8628	0.9645	0.9895	0.9948 (86)
MIT	18.4594	18.7115	19.1535	19.7522	20.3058	20.7079	20.8832	20.8403	20.4886	19.7658	19.0074	18.4216 (87)
Th 2	19.8384	19.8408	19.8432	19.8544	19.8565	19.8663	19.8663	19.8682	19.8626	19.8565	19.8523	19.8478 (88)
util rest of house	0.9922	0.9849	0.9676	0.9222	0.8257	0.6632	0.4873	0.5558	0.8107	0.9532	0.9868	0.9937 (89)
MIT 2	17.5138	17.7665	18.2067	18.8022	19.3297	19.6904	19.8188	19.7968	19.5145	18.8253	18.0705	17.4827 (90)
Living area fraction											fLA = Living area / (4) =	0.1137 (91)
MIT	17.6214	17.8739	18.3144	18.9102	19.4407	19.8061	19.9398	19.9154	19.6253	18.9322	18.1770	17.5894 (92)
Temperature adjustment												
adjusted MIT	17.6214	17.8739	18.3144	18.9102	19.4407	19.8061	19.9398	19.9154	19.6253	18.9322	18.1770	17.5894 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9883	0.9784	0.9567	0.9058	0.8094	0.6585	0.4962	0.5615	0.7970	0.9404	0.9811	0.9905 (94)
Useful gains	691.0519	849.2713	1006.7380	1143.4373	1147.7247	935.2067	669.5803	678.7856	835.0127	799.2668	688.6015	644.3146 (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	2995.0531	2909.9876	2643.7028	2215.2767	1709.4585	1138.5334	730.3939	767.3953	1212.9043	1840.0921	2456.5954	2982.5041 (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	1714.1769	1384.8013	1217.9018	771.7243	417.9299	0.0000	0.0000	0.0000	0.0000	774.3741	1272.9556	1739.6130 (98)
Space heating											9293.4769 (98)	
Space heating per m ²											(98) / (4) =	53.8659 (99)

FULL SAP CALCULATION PRINTOUT

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													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2055.6977	1618.3152	1659.0288	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6874	0.7605	0.7143	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1413.0744	1230.7496	1185.0105	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1769.2958	1684.7698	1527.1811	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	256.4794	337.7910	254.5749	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													848.8453 (104)
Intermittency factor (Table 10b)													1.0000 (105)
0.0000	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	0.0000	64.1198	84.4478	63.6437	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													212.2113 (107)
Space cooling per m2													1.2300 (108)
Energy for space heating													53.8659 (99)
Energy for space cooling													1.2300 (108)
Total													55.0959 (109)
Dwelling Fabric Energy Efficiency (DFEE)													55.1 (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	79.9400 (1b)	2.5200 (2b)	201.4488 (1b) - (3b)
First floor	92.5900 (1c)	2.6400 (2c)	244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.8864 (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) =	0.0897 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3397 (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) =		0.3397 (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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3992 (22b)
Effective ac	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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)			27.4500	1.3258	36.3920		(27)
TER Room Window (Uw = 1.70)			1.8000	1.5918	2.8652		(27a)
Ground Floor			55.3500	0.1300	7.1955		(28a)
Exposed Floor			24.5900	0.1300	3.1967		(28b)
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958		(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	9.6400	1.8000	7.8400	0.1300	1.0192		(30)
Pitched Cold Roof	67.9900		67.9900	0.1300	8.8387		(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)			395.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	99.5290		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							31.4974 (36)
Total fabric heat loss						(33) + (36) =	131.0264 (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	87.3733	86.8373	86.3120	83.8445	83.3828	81.2337	81.2337	80.8358	82.0615	83.3828	84.3168	85.2932 (38)
Heat transfer coeff	218.3997	217.8637	217.3384	214.8709	214.4093	212.2602	212.2602	211.8622	213.0880	214.4093	215.3432	216.3196 (39)
Average = Sum(39)m / 12 =												214.8687 (39)
HLP	1.2659	1.2628	1.2597	1.2454	1.2427	1.2303	1.2303	1.2280	1.2351	1.2427	1.2481	1.2538 (40)
HLP (average)												1.2454 (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												2.9659 (42)
Average daily hot water use (litres/day)												104.6413 (43)
Daily hot water use	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119 (45)
Energy content (annual)												Total = Sum(45)m = 1646.4149 (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	36.2733	31.7249	32.7372	28.5411	27.3859	23.6319	21.8985	25.1288	25.4289	29.6350	32.3489	35.1288 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974	148.2974 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	31.5855	28.0540	22.8150	17.2724	12.9113	10.9003	11.7782	15.3097	20.5486	26.0912	30.4523	32.4634 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	344.1212	347.6921	338.6935	319.5367	295.3546	272.6268	257.4433	253.8724	262.8709	282.0278	306.2099	328.9376 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297	37.8297 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380 (71)
Water heating gains (Table 5)	48.7545	47.2096	44.0017	39.6404	36.8090	32.8221	29.4334	33.7753	35.3179	39.8319	44.9290	47.2161 (72)
Total internal gains	491.9504	490.4449	472.9994	443.9388	412.5641	383.8385	366.1441	370.4466	386.2268	415.4402	449.0804	476.1063 (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	3.7800	11.2829	0.6300	0.7000	0.7700	13.0342 (75)						
Southeast	10.7200	36.7938	0.6300	0.7000	0.7700	120.5429 (77)						
Southwest	1.3400	36.7938	0.6300	0.7000	0.7700	15.0679 (79)						
Northwest	11.6100	11.2829	0.6300	0.7000	0.7700	40.0338 (81)						
North	1.8000	26.0000	0.6300	0.7000	1.0000	18.5749 (82)						
Solar gains	207.2537	377.5954	579.2625	818.3965	1005.4409	1036.3857	983.3440	838.5075	661.5300	434.4615	252.7796	174.3954 (83)
Total gains	699.2041	868.0404	1052.2619	1262.3352	1418.0050	1420.2242	1349.4881	1208.9541	1047.7568	849.9017	701.8600	650.5017 (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	54.8593	54.9942	55.1272	55.7602	55.8803	56.4461	56.4461	56.5521	56.2268	55.8803	55.6379	55.3868
alpha	4.6573	4.6663	4.6751	4.7173	4.7254	4.7631	4.7631	4.7701	4.7485	4.7254	4.7092	4.6925
util living area	0.9996	0.9989	0.9960	0.9827	0.9328	0.8076	0.6501	0.7276	0.9329	0.9935	0.9992	0.9997 (86)
MIT	19.4283	19.5916	19.8775	20.2726	20.6406	20.8865	20.9696	20.9490	20.7358	20.2583	19.7743	19.4059 (87)
Th 2	19.8677	19.8701	19.8725	19.8838	19.8860	19.8959	19.8959	19.8977	19.8920	19.8860	19.8817	19.8772 (88)
util rest of house	0.9995	0.9985	0.9945	0.9750	0.9006	0.7183	0.5072	0.5885	0.8862	0.9897	0.9988	0.9997 (89)
MIT 2	18.4277	18.5928	18.8799	19.2796	19.6300	19.8401	19.8878	19.8818	19.7282	19.2704	18.7846	18.4128 (90)
Living area fraction												fLA = Living area / (4) = 0.1137 (91)
MIT	18.5415	18.7064	18.9934	19.3925	19.7449	19.9591	20.0108	20.0032	19.8428	19.3828	18.8971	18.5258 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5415	18.7064	18.9934	19.3925	19.7449	19.9591	20.0108	20.0032	19.8428	19.3828	18.8971	18.5258 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	698.6850	866.1674	1044.5619	1224.9624	1269.7542	1028.5245	706.2001	729.6117	925.6443	838.9209	700.6707	650.1631 (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	3110.3380	3007.9079	2715.2873	2254.5383	1724.9108	1137.5184	723.9751	763.3819	1223.7146	1883.1072	2540.4350	3098.9416 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1794.2698	1439.2496	1243.0197	741.2946	338.6365	0.0000	0.0000	0.0000	0.0000	776.8746	1324.6303	1821.8912 (98)
Space heating												9479.8664 (98)
Space heating per m2												(98) / (4) = 54.9462 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

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

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1995.2454	1570.7251	1610.1525	0.0000	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7734	0.8541	0.8041	0.0000	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1543.1156	1341.5900	1294.7633	0.0000	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1769.2958	1684.7698	1527.1811	0.0000	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	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	162.8498	255.3258	172.9188	0.0000	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction													591.0944 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =				1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	40.7124	63.8314	43.2297	0.0000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling													147.7736 (107)
Space cooling per m2													0.8565 (108)
Energy for space heating													54.9462 (99)
Energy for space cooling													0.8565 (108)
Total													55.8027 (109)
Target Fabric Energy Efficiency (TFEE)													64.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.9400 (1b)	2.5200 (2b)	201.4488 (1b) - (3b)
First floor	92.5900 (1c)	2.6400 (2c)	244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.8864 (5)
Dwelling volume			

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) =	0.0897 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.3397 (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) =		0.3397 (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	0.3482	0.3227	0.3312	0.3142	0.3057	0.2803	0.2803	0.2718	0.2718	0.2888	0.2803	0.3142 (22b)
	0.5606	0.5521	0.5549	0.5494	0.5467	0.5393	0.5393	0.5369	0.5369	0.5417	0.5393	0.5494 (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)			27.4500	1.3258	36.3920		(27)					
Garage Door			2.1000	1.4000	2.9400		(26)					
Lantern Rooflight (Uw = 1.40)			1.8000	1.3258	2.3864		(27a)					
Ground Floor			55.3500	0.1200	6.6420	75.0000	4151.2500 (28a)					
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)					
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958	60.0000	10098.6000 (29a)					
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	9.0000	61.0200 (29a)					
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)					
Flat Roof	9.6400	1.8000	7.8400	0.1400	1.0976	9.0000	70.5600 (30)					
Pitched Cold Roof	67.9900		67.9900	0.1000	6.7990	9.0000	611.9100 (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)			395.8900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8527		(33)					
Party Walls			10.5600	0.0000	0.0000	70.0000	739.2000 (32)					
Internal Wall Masonry			40.0500			75.0000	3003.7500 (32c)					
Internal Wall Timber			163.9400			9.0000	1475.4600 (32c)					
Internal Floor			67.9900			18.0000	1223.8200 (32d)					
Internal Ceiling			67.9900			18.0000	1223.8200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23433.3400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8218 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							38.6048 (36)					
Total fabric heat loss						(33) + (36) =	137.4575 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 82.4914	Feb 81.2337	Mar 81.6423	Apr 80.8358	May 80.4484	Jun 79.3500	Jul 79.3500	Aug 79.0050	Sep 79.0050	Oct 79.7055	Nov 79.3500	Dec 80.8358 (38)
Heat transfer coeff	219.9489	218.6912	219.0998	218.2933	217.9059	216.8075	216.8075	216.4625	216.4625	217.1630	216.8075	218.2933 (39)
Average = Sum(39)m / 12 =												217.7286 (39)
HLP	Jan 1.2748	Feb 1.2676	Mar 1.2699	Apr 1.2652	May 1.2630	Jun 1.2566	Jul 1.2566	Aug 1.2546	Sep 1.2546	Oct 1.2587	Nov 1.2566	Dec 1.2652 (40)
HLP (average)												1.2620 (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												2.9659 (42)
Average daily hot water use (litres/day)												104.6413 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054 (44)
Energy content (annual)	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1646.4149 (45)
Water storage loss:	25.6047	22.3940	23.1086	20.1467	19.3312	16.6814	15.4577	17.7380	17.9498	20.9188	22.8345	24.7968 (46)
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	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (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	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (64)
RHI water heating demand												Total per year (kWh/year) = Sum(64)m = 2304.6559 (64)
Heat gains from water heating, kWh/month	101.4814	90.0363	95.9485	87.9401	87.5752	80.2586	78.9890	84.0435	83.0704	91.0943	93.8981	99.6905 (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	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.9637	70.1349	57.0375	43.1811	32.2784	27.2508	29.4454	38.2743	51.3716	65.2281	76.1308	81.1584 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	513.6137	518.9434	505.5127	476.9204	440.8277	406.9057	384.2437	378.9140	392.3447	420.9370	457.0297	490.9517 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380 (71)
Water heating gains (Table 5)	136.3997	133.9825	128.9630	122.1390	117.7086	111.4703	106.1680	112.9617	115.3755	122.4386	130.4140	133.9926 (72)
Total internal gains	844.0578	838.1415	806.5939	757.3211	705.8953	660.7074	634.9377	645.2306	674.1724	723.6843	778.6551	821.1834 (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	3.7800	14.6223	0.6300	0.7000	0.7700	16.8920 (75)						
Southeast	10.7200	45.2918	0.6300	0.7000	0.7700	148.3836 (77)						
Southwest	1.3400	45.2918	0.6300	0.7000	0.7700	18.5479 (79)						
Northwest	11.6100	14.6223	0.6300	0.7000	0.7700	51.8825 (81)						
North	1.8000	34.0000	0.6300	0.7000	1.0000	24.2903 (82)						
Solar gains	259.9962	404.6861	623.4369	887.8836	1035.3728	1161.4125	1082.0321	946.1665	749.4001	497.0547	309.0510	206.8899 (83)
Total gains	1104.0540	1242.8276	1430.0308	1645.2047	1741.2681	1822.1199	1716.9697	1591.3971	1423.5725	1220.7389	1087.7061	1028.0733 (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	29.5944	29.7646	29.7091	29.8189	29.8719	30.0232	30.0232	30.0711	30.0711	29.9741	30.0232	29.8189
alpha	2.9730	2.9843	2.9806	2.9879	2.9915	3.0015	3.0015	3.0047	3.0047	2.9983	3.0015	2.9879
util living area	0.9779	0.9672	0.9394	0.8761	0.7635	0.5769	0.4199	0.4693	0.7214	0.9035	0.9640	0.9816 (86)
MIT	19.4044	19.5709	19.8852	20.2756	20.6135	20.8227	20.8868	20.8770	20.7284	20.3152	19.8128	19.3736 (87)
Th 2	19.8606	19.8663	19.8645	19.8682	19.8699	19.8750	19.8750	19.8765	19.8765	19.8733	19.8750	19.8682 (88)
util rest of house	0.9734	0.9604	0.9263	0.8483	0.7075	0.4826	0.2942	0.3406	0.6383	0.8751	0.9551	0.9778 (89)
MIT 2	17.7455	17.9901	18.4399	18.9896	19.4387	19.6809	19.7348	19.7311	19.5922	19.0610	18.3489	17.7063 (90)
Living area fraction												fLA = Living area / (4) = 0.1137 (91)
MIT	17.9341	18.1698	18.6043	19.1359	19.5723	19.8107	19.8658	19.8614	19.7214	19.2037	18.5154	17.8959 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9341	18.1698	18.6043	19.1359	19.5723	19.8107	19.8658	19.8614	19.7214	19.2037	18.5154	17.8959 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9624	0.9465	0.9074	0.8263	0.6905	0.4767	0.2931	0.3387	0.6249	0.8533	0.9402	0.9681	(94)
Useful gains	1062.5764	1176.2952	1297.5819	1359.3588	1202.2859	868.6742	503.2761	539.0173	889.6386	1041.6714	1022.6409	995.3069	(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													
	2844.8458	2748.9110	2476.7683	2059.7901	1497.5047	934.5972	512.9246	554.4459	1043.6474	1672.9502	2279.8078	2815.0919	(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													
	1326.0084	1056.7978	877.3147	504.3105	219.6428	0.0000	0.0000	0.0000	0.0000	469.6714	905.1602	1353.9200	(98)
Space heating													6712.8259 (98)
RHI space heating demand													6713 (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 (m2)	Storey height (m)	Volume (m3)
Ground floor	79.9400 (1b)	x 2.5200 (2b)	= 201.4488 (1b) - (3b)
First floor	92.5900 (1c)	x 2.6400 (2c)	= 244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.8864 (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) =	0.0897 (8)							
Pressure test					Yes							
Measured/design AP50					5.0000							
Infiltration rate					0.3397 (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) =		0.3397 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3992 (22b)
	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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)			27.4500	1.3258	36.3920		(27)					
Garage Door			2.1000	1.4000	2.9400		(26)					
Lantern Rooflight (Uw = 1.40)			1.8000	1.3258	2.3864		(27a)					
Ground Floor			55.3500	0.1200	6.6420	75.0000	4151.2500 (28a)					
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)					
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958	60.0000	10098.6000 (29a)					
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	9.0000	61.0200 (29a)					
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)					
Flat Roof	9.6400	1.8000	7.8400	0.1400	1.0976	9.0000	70.5600 (30)					
Pitched Cold Roof	67.9900		67.9900	0.1000	6.7990	9.0000	611.9100 (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)			395.8900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8527		(33)					
Party Walls			10.5600	0.0000	0.0000	70.0000	739.2000 (32)					
Internal Wall Masonry			40.0500			75.0000	3003.7500 (32c)					
Internal Wall Timber			163.9400			9.0000	1475.4600 (32c)					
Internal Floor			67.9900			18.0000	1223.8200 (32d)					
Internal Ceiling			67.9900			18.0000	1223.8200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23433.3400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							135.8218 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							38.6048 (36)					
Total fabric heat loss						(33) + (36) =	137.4575 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 87.3733	Feb 86.8373	Mar 86.3120	Apr 83.8445	May 83.3828	Jun 81.2337	Jul 81.2337	Aug 80.8358	Sep 82.0615	Oct 83.3828	Nov 84.3168	Dec 85.2932 (38)
Heat transfer coeff	224.8308	224.2948	223.7695	221.3020	220.8403	218.6912	218.6912	218.2933	219.5190	220.8403	221.7743	222.7507 (39)
Average = Sum(39)m / 12 =												221.2998 (39)
HLP	Jan 1.3031	Feb 1.3000	Mar 1.2970	Apr 1.2827	May 1.2800	Jun 1.2676	Jul 1.2676	Aug 1.2652	Sep 1.2724	Oct 1.2800	Nov 1.2854	Dec 1.2911 (40)
HLP (average)												1.2827 (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												2.9659 (42)
Average daily hot water use (litres/day)												104.6413 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054 (44)
Energy conte	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119 (45)
Energy content (annual)												Total = Sum(45)m = 1646.4149 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6047	22.3940	23.1086	20.1467	19.3312	16.6814	15.4577	17.7380	17.9498	20.9188	22.8345	24.7968 (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	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (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	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (64)
Heat gains from water heating, kWh/month	101.4814	90.0363	95.9485	87.9401	87.5752	80.2586	78.9890	84.0435	83.0704	91.0943	93.8981	99.6905 (65)
Total per year (kWh/year) = Sum(64)m = 2304.6559 (64)												

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
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	78.9637	70.1349	57.0375	43.1811	32.2784	27.2508	29.4454	38.2743	51.3716	65.2281	76.1308	81.1584 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	513.6137	518.9434	505.5127	476.9204	440.8277	406.9057	384.2437	378.9140	392.3447	420.9370	457.0297	490.9517 (68)
Pumps, fans	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616 (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)	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380 (71)
Total internal gains	136.3997	133.9825	128.9630	122.1390	117.7086	111.4703	106.1680	112.9617	115.3755	122.4386	130.4140	133.9926 (72)
	844.0578	838.1415	806.5939	757.3211	705.8953	660.7074	634.9377	645.2306	674.1724	723.6843	778.6551	821.1834 (73)

6. Solar gains												
[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	3.7800	11.2829	0.6300	0.7000	0.7700	13.0342 (75)						
Southeast	10.7200	36.7938	0.6300	0.7000	0.7700	120.5429 (77)						
Southwest	1.3400	36.7938	0.6300	0.7000	0.7700	15.0679 (79)						
Northwest	11.6100	11.2829	0.6300	0.7000	0.7700	40.0338 (81)						
North	1.8000	26.0000	0.6300	0.7000	1.0000	18.5749 (82)						
Solar gains	207.2537	377.5954	579.2625	818.3965	1005.4409	1036.3857	983.3440	838.5075	661.5300	434.4615	252.7796	174.3954 (83)
Total gains	1051.3115	1215.7369	1385.8564	1575.7175	1711.3362	1697.0931	1618.2817	1483.7381	1335.7024	1158.1458	1031.4347	995.5787 (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	28.9518	29.0210	29.0891	29.4135	29.4750	29.7646	29.7646	29.8189	29.6524	29.4750	29.3508	29.2222
alpha	2.9301	2.9347	2.9393	2.9609	2.9650	2.9843	2.9843	2.9879	2.9768	2.9650	2.9567	2.9481
util living area	0.9826	0.9724	0.9513	0.9024	0.8114	0.6730	0.5361	0.5904	0.7935	0.9303	0.9735	0.9851 (86)
MIT	19.2420	19.4201	19.7272	20.1360	20.4995	20.7507	20.8514	20.8307	20.6288	20.1580	19.6303	19.2126 (87)
Th 2	19.8384	19.8408	19.8432	19.8544	19.8565	19.8663	19.8663	19.8682	19.8626	19.8565	19.8523	19.8478 (88)
util rest of house	0.9791	0.9669	0.9410	0.8806	0.7666	0.5915	0.4191	0.4743	0.7278	0.9102	0.9672	0.9821 (89)
MIT 2	17.4944	17.7540	18.1987	18.7866	19.2821	19.6003	19.7016	19.6880	19.4654	18.8302	18.0696	17.4581 (90)
Living area fraction	fLA = Living area / (4) = 0.1137 (91)											
MIT	17.6931	17.9435	18.3725	18.9400	19.4205	19.7312	19.8323	19.8180	19.5977	18.9812	18.2471	17.6576 (92)
Temperature adjustment	0.0000											
adjusted MIT	17.6931	17.9435	18.3725	18.9400	19.4205	19.7312	19.8323	19.8180	19.5977	18.9812	18.2471	17.6576 (93)

8. Space heating requirement												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Utilisation	0.9697	0.9541	0.9235	0.8586	0.7464	0.5805	0.4152	0.4686	0.7094	0.8896	0.9546	0.9738 (94)
Useful gains	1019.4591	1159.9811	1279.7921	1352.9495	1277.3493	985.1727	671.9825	695.2791	947.5607	1030.2679	984.6219	969.4512 (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												
	3011.1804	2925.5891	2656.7019	2221.8759	1705.0010	1122.1396	706.8846	746.1163	1206.8543	1850.9035	2472.1457	2997.6861 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	1481.8407	1186.4886	1024.4209	625.6270	318.1729	0.0000	0.0000	0.0000	0.0000	610.5528	1071.0171	1509.0068 (98)
Space heating												7827.1269 (98)
Space heating per m2												(98) / (4) = 45.3668 (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												7766.7191 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1481.8407	1186.4886	1024.4209	625.6270	318.1729	0.0000	0.0000	0.0000	0.0000	610.5528	1071.0171	1509.0068 (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)	1470.4042	1177.3316	1016.5147	620.7986	315.7173	0.0000	0.0000	0.0000	0.0000	605.8408	1062.7513	1497.3607 (211)
Water heating requirement	227.9755	182.5367	157.6032	96.2503	48.9497	0.0000	0.0000	0.0000	0.0000	93.9312	164.7719	232.1549 (215)
Water heating												
Water heating requirement	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (64)
Efficiency of water heater												80.0000 (216)
(217)m	88.9717	88.8275	88.5043	87.7571	86.1793	80.0000	80.0000	80.0000	80.0000	87.6261	88.6104	89.0320 (217)
Fuel for water heating, kWh/month	254.6915	224.9177	237.2348	214.6984	214.4136	206.6389	198.6962	217.6982	217.2094	222.9520	232.8531	248.4693 (219)
Water heating fuel used												2690.4731 (219)
Annual totals kWh/year												
Space heating fuel - main system												7766.7191 (211)
Space heating fuel - secondary												1204.1734 (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)												557.8098 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.90 * 1029 * 1.00) =										-2387.7132		-2387.7132 (233)
Total delivered energy for all uses												9906.4622 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7766.7191	3.4800	270.2818 (240)
Space heating - secondary	1204.1734	4.2300	50.9365 (242)
Water heating (other fuel)	2690.4731	3.4800	93.6285 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	557.8098	13.1900	73.5751 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-2387.7132	13.1900	-314.9394 (252)
Total energy cost			303.3751 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.5857 (257)
SAP value			91.8288
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	7766.7191	0.2160	1677.6113 (261)
Space heating - secondary	1204.1734	0.0190	22.8793 (263)
Water heating (other fuel)	2690.4731	0.2160	581.1422 (264)
Space and water heating			2281.6328 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy for lighting	557.8098	0.5190	289.5033 (268)
Energy saving/generation technologies			
PV Unit	-2387.7132	0.5190	-1239.2231 (269)
Total kg/year			1370.8379 (272)
CO2 emissions per m2			7.9500 (273)
EI value			91.5555
EI rating			92 (274)
EI band			A

 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	$3.48 / 0.8546 = 4.072$, stars = 4
Water heating environmental impact	$0.216 / 0.8546 = 0.2528$, 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	79.9400 (1b)	2.5200 (2b)	201.4488 (1b) - (3b)
First floor	92.5900 (1c)	2.6400 (2c)	244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		445.8864 (5)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =

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) =	0.0897 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.3397 (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) =		0.3397 (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	0.3482	0.3227	0.3312	0.3142	0.3057	0.2803	0.2803	0.2718	0.2718	0.2888	0.2803	0.3142 (22b)
	0.5606	0.5521	0.5549	0.5494	0.5467	0.5393	0.5393	0.5369	0.5369	0.5417	0.5393	0.5494 (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)			27.4500	1.3258	36.3920		(27)					
Garage Door			2.1000	1.4000	2.9400		(26)					
Lantern Rooflight (Uw = 1.40)			1.8000	1.3258	2.3864		(27a)					
Ground Floor			55.3500	0.1200	6.6420	75.0000	4151.2500 (28a)					
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)					
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958	60.0000	10098.6000 (29a)					
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	9.0000	61.0200 (29a)					
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)					
Flat Roof	9.6400	1.8000	7.8400	0.1400	1.0976	9.0000	70.5600 (30)					
Pitched Cold Roof	67.9900		67.9900	0.1000	6.7990	9.0000	611.9100 (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)			395.8900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8527		(33)					
Party Walls			10.5600	0.0000	0.0000	70.0000	739.2000 (32)					
Internal Wall Masonry			40.0500			75.0000	3003.7500 (32c)					
Internal Wall Timber			163.9400			9.0000	1475.4600 (32c)					
Internal Floor			67.9900			18.0000	1223.8200 (32d)					
Internal Ceiling			67.9900			18.0000	1223.8200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23433.3400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8218 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							38.6048 (36)					
Total fabric heat loss						(33) + (36) =	137.4575 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 82.4914	Feb 81.2337	Mar 81.6423	Apr 80.8358	May 80.4484	Jun 79.3500	Jul 79.3500	Aug 79.0050	Sep 79.0050	Oct 79.7055	Nov 79.3500	Dec 80.8358 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	219.9489	218.6912	219.0998	218.2933	217.9059	216.8075	216.8075	216.4625	216.4625	217.1630	216.8075	218.2933 (39)
												217.7286 (39)
HLP	Jan 1.2748	Feb 1.2676	Mar 1.2699	Apr 1.2652	May 1.2630	Jun 1.2566	Jul 1.2566	Aug 1.2546	Sep 1.2546	Oct 1.2587	Nov 1.2566	Dec 1.2652 (40)
HLP (average)												1.2620 (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											2.9659 (42)	
Average daily hot water use (litres/day)											104.6413 (43)	
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054 (44)
Energy conte	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119 (45)
Energy content (annual)											Total = Sum(45)m =	1646.4149 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.6047	22.3940	23.1086	20.1467	19.3312	16.6814	15.4577	17.7380	17.9498	20.9188	22.8345	24.7968 (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												
	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (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												
	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (64)
											Total per year (kWh/year) = Sum(64)m =	2304.6559 (64)
Heat gains from water heating, kWh/month												
	101.4814	90.0363	95.9485	87.9401	87.5752	80.2586	78.9890	84.0435	83.0704	91.0943	93.8981	99.6905 (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
	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	78.9637	70.1349	57.0375	43.1811	32.2784	27.2508	29.4454	38.2743	51.3716	65.2281	76.1308	81.1584 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	513.6137	518.9434	505.5127	476.9204	440.8277	406.9057	384.2437	378.9140	392.3447	420.9370	457.0297	490.9517 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380 (71)
Water heating gains (Table 5)												
	136.3997	133.9825	128.9630	122.1390	117.7086	111.4703	106.1680	112.9617	115.3755	122.4386	130.4140	133.9926 (72)
Total internal gains												
	844.0578	838.1415	806.5939	757.3211	705.8953	660.7074	634.9377	645.2306	674.1724	723.6843	778.6551	821.1834 (73)

6. Solar gains												

[Jan]	Area	Solar flux	g	FF	Access	Gains						
	m2	Table 6a	Specific data	Specific data	factor	W						
		W/m2	or Table 6b	or Table 6c	Table 6d							
Northeast	3.7800	14.6223	0.6300	0.7000	0.7700	16.8920 (75)						
Southeast	10.7200	45.2918	0.6300	0.7000	0.7700	148.3836 (77)						
Southwest	1.3400	45.2918	0.6300	0.7000	0.7700	18.5479 (79)						
Northwest	11.6100	14.6223	0.6300	0.7000	0.7700	51.8825 (81)						
North	1.8000	34.0000	0.6300	0.7000	1.0000	24.2903 (82)						
Solar gains	259.9962	404.6861	623.4369	887.8836	1035.3728	1161.4125	1082.0321	946.1665	749.4001	497.0547	309.0510	206.8899 (83)
Total gains	1104.0540	1242.8276	1430.0308	1645.2047	1741.2681	1822.1199	1716.9697	1591.3971	1423.5725	1220.7389	1087.7061	1028.0733 (84)

7. Mean internal temperature (heating season)												

Temperature during heating periods in the living area from Table 9, Thl (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	29.5944	29.7646	29.7091	29.8189	29.8719	30.0232	30.0232	30.0711	30.0711	29.9741	30.0232	29.8189
alpha	2.9730	2.9843	2.9806	2.9879	2.9915	3.0015	3.0015	3.0047	3.0047	2.9983	3.0015	2.9879
util living area	0.9779	0.9672	0.9394	0.8761	0.7635	0.5769	0.4199	0.4693	0.7214	0.9035	0.9640	0.9816 (86)
MIT	19.4044	19.5709	19.8852	20.2756	20.6135	20.8227	20.8868	20.8770	20.7284	20.3152	19.8128	19.3736 (87)
Th 2	19.8606	19.8663	19.8645	19.8682	19.8699	19.8750	19.8750	19.8765	19.8765	19.8733	19.8750	19.8682 (88)
util rest of house	0.9734	0.9604	0.9263	0.8483	0.7075	0.4826	0.2942	0.3406	0.6383	0.8751	0.9551	0.9778 (89)
MIT 2	17.7455	17.9901	18.4399	18.9896	19.4387	19.6809	19.7348	19.7311	19.5922	19.0610	18.3489	17.7063 (90)
Living area fraction											fLA = Living area / (4) =	0.1137 (91)
MIT	17.9341	18.1698	18.6043	19.1359	19.5723	19.8107	19.8658	19.8614	19.7214	19.2037	18.5154	17.8959 (92)
Temperature adjustment											0.0000	
adjusted MIT	17.9341	18.1698	18.6043	19.1359	19.5723	19.8107	19.8658	19.8614	19.7214	19.2037	18.5154	17.8959 (93)

8. Space heating requirement												

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Utilisation	0.9624	0.9465	0.9074	0.8263	0.6905	0.4767	0.2931	0.3387	0.6249	0.8533	0.9402	0.9681 (94)
Useful gains	1062.5764	1176.2952	1297.5819	1359.3588	1202.2859	868.6742	503.2761	539.0173	889.6386	1041.6714	1022.6409	995.3069 (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	2844.8458	2748.9110	2476.7683	2059.7901	1497.5047	934.5972	512.9246	554.4459	1043.6474	1672.9502	2279.8078	2815.0919 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1326.0084	1056.7978	877.3147	504.3105	219.6428	0.0000	0.0000	0.0000	0.0000	469.6714	905.1602	1353.9200 (98)
Space heating												6712.8259 (98)
Space heating per m2												(98) / (4) = 38.9082 (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												6661.0180 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1326.0084	1056.7978	877.3147	504.3105	219.6428	0.0000	0.0000	0.0000	0.0000	469.6714	905.1602	1353.9200 (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)	1315.7746	1048.6417	870.5438	500.4184	217.9477	0.0000	0.0000	0.0000	0.0000	466.0466	898.1744	1343.4708 (211)
Water heating requirement	204.0013	162.5843	134.9715	77.5862	33.7912	0.0000	0.0000	0.0000	0.0000	72.2571	139.2554	208.2954 (215)
Water heating requirement	226.6034	199.7888	209.9630	188.4131	184.7801	165.3111	158.9570	174.1586	173.7675	195.3640	206.3320	221.2173 (64)
Efficiency of water heater	88.8046	88.6419	88.2214	87.2757	85.1947	80.0000	80.0000	80.0000	80.0000	87.0210	88.3129	88.8736 (217)
Fuel for water heating, kWh/month	255.1708	225.3886	237.9955	215.8826	216.8915	206.6389	198.6962	217.6982	217.2094	224.5021	233.6374	248.9123 (219)
Water heating fuel used												2698.6235 (219)
Annual totals kWh/year												
Space heating fuel - main system												6661.0180 (211)
Space heating fuel - secondary												1032.7424 (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)												557.8098 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.90 * 1139 * 1.00) =										-2642.6853		-2642.6853 (233)
Total delivered energy for all uses												8382.5084 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6661.0180	9.7400	648.7832 (240)
Space heating - secondary	1032.7424	10.2500	105.8561 (242)
Water heating (other fuel)	2698.6235	9.7400	262.8459 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	557.8098	36.8500	205.5529 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit		-2642.6853	-973.8295 (252)
Total energy cost			380.8460 (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	6661.0180	0.2160	1438.7799 (261)
Space heating - secondary	1032.7424	0.0190	19.6221 (263)
Water heating (other fuel)	2698.6235	0.2160	582.9027 (264)
Space and water heating			2041.3047 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	557.8098	0.5190	289.5033 (268)
Energy saving/generation technologies			
PV Unit		-2642.6853	-1371.5537 (269)
Total kg/year			998.1793 (272)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	6661.0180	1.2200	8126.4419 (261)
Space heating - secondary	1032.7424	1.0400	1074.0521 (263)
Water heating (other fuel)	2698.6235	1.2200	3292.3207 (264)
Space and water heating			12492.8148 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	557.8098	3.0700	1712.4761 (268)
Energy saving/generation technologies			
PV Unit	-2642.6853	3.0700	-8113.0440 (269)
Primary energy kWh/year			6322.4968 (272)
Primary energy kWh/m2/year			36.6458 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:
 N Solar water heating SAP change + 1.1 Cost change -£ 116 CO2 change -273 kg (27.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£116 1.58 kg/m ²	A 93	A 93
Total Savings	£116 1.58 kg/m²		

Potential energy efficiency rating: A 93
 Potential environmental impact rating: A 93

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	£233	£252	-£18
Mains gas	£1016	£881	£135
Wood	£106	£107	-£1
Space heating	£886	£892	-£5
Water heating	£263	£142	£121
Lighting	£206	£206	£0
Generated (PV)	-£974	-£974	£0
Total cost of fuels	£381	£266	£116
Total cost of uses	£381	£266	£116
Delivered energy	49 kWh/m ²	41 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	0.7 tonnes	0.3 tonnes
CO2 emissions per m ²	6 kg/m ²	4 kg/m ²	2 kg/m ²
Primary energy	37 kWh/m ²	28 kWh/m ²	9 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	79.9400 (1b)	x 2.5200 (2b)	= 201.4488 (1b) - (3b)
First floor	92.5900 (1c)	x 2.6400 (2c)	= 244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.8864 (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) =	0.0897 (8)							
Pressure test				Yes								
Measured/design AP50				5.0000								
Infiltration rate				0.3397 (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) =		0.3397 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4331	0.4246	0.4161	0.3737	0.3652	0.3227	0.3227	0.3142	0.3397	0.3652	0.3822	0.3992 (22b)
	0.5938	0.5902	0.5866	0.5698	0.5667	0.5521	0.5521	0.5494	0.5577	0.5667	0.5730	0.5797 (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)			27.4500	1.3258	36.3920		(27)					
Garage Door			2.1000	1.4000	2.9400		(26)					
Lantern Rooflight (Uw = 1.40)			1.8000	1.3258	2.3864		(27a)					
Ground Floor			55.3500	0.1200	6.6420	75.0000	4151.2500 (28a)					
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)					
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958	60.0000	10098.6000 (29a)					
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	9.0000	61.0200 (29a)					
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)					
Flat Roof	9.6400	1.8000	7.8400	0.1400	1.0976	9.0000	70.5600 (30)					
Pitched Cold Roof	67.9900		67.9900	0.1000	6.7990	9.0000	611.9100 (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)			395.8900				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8527		(33)					
Party Walls			10.5600	0.0000	0.0000	70.0000	739.2000 (32)					
Internal Wall Masonry			40.0500			75.0000	3003.7500 (32c)					
Internal Wall Timber			163.9400			9.0000	1475.4600 (32c)					
Internal Floor			67.9900			18.0000	1223.8200 (32d)					
Internal Ceiling			67.9900			18.0000	1223.8200 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23433.3400 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							135.8218 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							38.6048 (36)					
Total fabric heat loss						(33) + (36) =	137.4575 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 87.3733	Feb 86.8373	Mar 86.3120	Apr 83.8445	May 83.3828	Jun 81.2337	Jul 81.2337	Aug 80.8358	Sep 82.0615	Oct 83.3828	Nov 84.3168	Dec 85.2932 (38)
Heat transfer coeff	224.8308	224.2948	223.7695	221.3020	220.8403	218.6912	218.6912	218.2933	219.5190	220.8403	221.7743	222.7507 (39)
Average = Sum(39)m / 12 =												221.2998 (39)
HLP	Jan 1.3031	Feb 1.3000	Mar 1.2970	Apr 1.2827	May 1.2800	Jun 1.2676	Jul 1.2676	Aug 1.2652	Sep 1.2724	Oct 1.2800	Nov 1.2854	Dec 1.2911 (40)
HLP (average)												1.2827 (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 FOR IMPROVED DWELLING 09 Jan 2014

Assumed occupancy												2.9659 (42)
Average daily hot water use (litres/day)												104.6413 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054 (44)
Distribution loss (46)m = 0.15 x (45)m	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119 (45)
Water storage loss:												1646.4149 (45)
Store volume	25.6047	22.3940	23.1086	20.1467	19.3312	16.6814	15.4577	17.7380	17.9498	20.9188	22.8345	24.7968 (46)
a) If manufacturer declared loss factor is known (kWh/day):												210.0000 (47)
Temperature factor from Table 2b												1.9500 (48)
Enter (49) or (54) in (55)												0.5400 (49)
Total storage loss												1.0530 (55)
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 (56)
Primary loss	20.9848	18.9540	20.9848	20.3079	20.9848	20.3079	20.9848	20.9848	20.3079	20.9848	20.3079	20.9848 (57)
Total heat required for water heating calculated for each month	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Aperture area of solar collector	214.9452	189.2588	196.9090	170.3774	160.3276	141.4222	134.2718	150.4039	157.0825	182.3101	195.0498	209.5591 (62)
Zero-loss collector efficiency												3.0000 (H1)
Collector heat loss coefficient												0.7000 (H2)
Collector 2nd order heat loss coefficient												1.8000 (H3)
Collector effective heat loss coefficient												0.0050 (H3a)
Collector performance ratio												1.8063 (H3b)
Annual solar radiation per m2												2.5804 (H4)
Overshading factor												1079.5246 (H5)
Solar energy available												0.8000 (H6)
Adjustment factor for showers												1813.6014 (H7)
Solar-to-load ratio												1.0000 (H7a)
Utilisation factor												1.1015 (H8)
Collector performance factor												0.5966 (H9)
Dedicated solar storage volume												0.8793 (H10)
Effective solar volume												75.0000 (H11)
Daily hot water demand												115.5000 (H13)
Volume ratio Veff/V												104.6413 (H14)
Solar storage volume factor												1.1038 (H15)
Solar input												1.0000 (H16)
Solar input	-27.5882	-46.0368	-78.4060	-105.0794	-129.8168	-127.6306	-125.9439	-110.0378	-86.1817	-58.8519	-32.7236	-951.3834 (H17)
Output from w/h	187.3570	143.2220	118.5031	65.2980	30.5108	13.7916	8.3279	40.3661	70.9008	123.4581	162.3262	186.4725 (64)
Heat gains from water heating, kWh/month	92.1548	81.6123	85.5053	73.5115	68.0131	61.1475	59.2408	65.0398	69.7224	80.6511	84.8724	90.3640 (65)
5. Internal gains (see Table 5 and 5a)												1150.5341 (64)
Metabolic gains (Table 5), Watts	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.9637	70.1349	57.0375	43.1811	32.2784	27.2508	29.4454	38.2743	51.3716	65.2281	76.1308	81.1584 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	513.6137	518.9434	505.5127	476.9204	440.8277	406.9057	384.2437	378.9140	392.3447	420.9370	457.0297	490.9517 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380 (71)
Water heating gains (Table 5)	123.8640	121.4468	114.9265	102.0992	91.4155	84.9271	79.6248	87.4191	96.8366	108.4021	117.8783	121.4569 (72)
Total internal gains	831.5221	825.6058	792.5574	737.2814	679.6022	634.1642	608.3945	619.6879	655.6335	709.6478	766.1194	808.6477 (73)
6. Solar gains												
[Jan]	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m2	Table 6a	W/m2	or Table 6b	or Table 6c	factor	W					
						Table 6d						
Northeast	3.7800	11.2829	0.6300		0.7000	0.7700	13.0342 (75)					
Southeast	10.7200	36.7938	0.6300		0.7000	0.7700	120.5429 (77)					
Southwest	1.3400	36.7938	0.6300		0.7000	0.7700	15.0679 (79)					
Northwest	11.6100	11.2829	0.6300		0.7000	0.7700	40.0338 (81)					
North	1.8000	26.0000	0.6300		0.7000	1.0000	18.5749 (82)					
Solar gains	207.2537	377.5954	579.2625	818.3965	1005.4409	1036.3857	983.3440	838.5075	661.5300	434.4615	252.7796	174.3954 (83)
Total gains	1038.7758	1203.2012	1371.8198	1555.6778	1685.0431	1670.5499	1591.7385	1458.1955	1317.1635	1144.1093	1018.8989	983.0430 (84)
7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	28.9518	29.0210	29.0891	29.4135	29.4750	29.7646	29.7646	29.8189	29.6524	29.4750	29.3508	29.2222
util living area	2.9301	2.9347	2.9393	2.9609	2.9650	2.9843	2.9843	2.9879	2.9768	2.9650	2.9567	2.9481

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.9831	0.9731	0.9524	0.9050	0.8164	0.6794	0.5430	0.5978	0.7982	0.9322	0.9743	0.9856 (86)
MIT	19.2348	19.4131	19.7200	20.1274	20.4914	20.7463	20.8493	20.8280	20.6236	20.1513	19.6233	19.2053 (87)
Th 2	19.8384	19.8408	19.8432	19.8544	19.8565	19.8663	19.8663	19.8682	19.8626	19.8565	19.8523	19.8478 (88)
util rest of house												
	0.9797	0.9677	0.9423	0.8836	0.7722	0.5981	0.4252	0.4812	0.7332	0.9125	0.9682	0.9827 (89)
MIT 2	17.4839	17.7441	18.1885	18.7749	19.2723	19.5962	19.7003	19.6861	19.4596	18.8210	18.0596	17.4475 (90)
Living area fraction									fLA = Living area / (4) =			0.1137 (91)
MIT	17.6830	17.9339	18.3626	18.9287	19.4110	19.7270	19.8310	19.8160	19.5920	18.9723	18.2374	17.6474 (92)
Temperature adjustment												0.0000
adjusted MIT	17.6830	17.9339	18.3626	18.9287	19.4110	19.7270	19.8310	19.8160	19.5920	18.9723	18.2374	17.6474 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9705	0.9552	0.9250	0.8617	0.7517	0.5868	0.4211	0.4752	0.7145	0.8921	0.9558	0.9745 (94)
Useful gains	1008.1621	1149.2572	1268.9496	1340.5507	1266.6788	980.2703	670.3461	692.9226	941.1389	1020.6058	973.8851	958.0031 (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	3008.9195	2923.4272	2654.4958	2219.3628	1702.8917	1121.2224	706.5824	745.6795	1205.5973	1848.9435	2469.9971	2995.4152 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1488.5635	1192.2422	1030.8464	632.7447	324.5423	0.0000	0.0000	0.0000	0.0000	616.2833	1077.2006	1515.8346 (98)
Space heating												7878.2577 (98)
Space heating per m2											(98) / (4) =	45.6631 (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												7817.4553 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1488.5635	1192.2422	1030.8464	632.7447	324.5423	0.0000	0.0000	0.0000	0.0000	616.2833	1077.2006	1515.8346 (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)	1477.0752	1183.0408	1022.8906	627.8614	322.0376	0.0000	0.0000	0.0000	0.0000	611.5270	1068.8871	1504.1357 (211)
Water heating requirement	229.0098	183.4219	158.5918	97.3453	49.9296	0.0000	0.0000	0.0000	0.0000	94.8128	165.7232	233.2053 (215)
Water heating requirement	187.3570	143.2220	118.5031	65.2980	30.5108	13.7916	8.3279	40.3661	70.9008	123.4581	162.3262	186.4725 (64)
Efficiency of water heater (217)m	89.2357	89.2936	89.3465	89.4690	89.5670	80.0000	80.0000	80.0000	80.0000	88.5439	88.9929	89.2643 (217)
Fuel for water heating, kWh/month	209.9575	160.3944	132.6331	72.9839	34.0648	17.2396	10.4099	50.4576	88.6260	139.4315	182.4036	208.8992 (219)
Water heating fuel used												1307.5012 (219)
Annual totals kWh/year												
Space heating fuel - main system												7817.4553 (211)
Space heating fuel - secondary												1212.0397 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												125.0000 (231)
Electricity for lighting (calculated in Appendix L)												557.8098 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.90 * 1029 * 1.00) =										-2387.7132		-2387.7132 (233)
Total delivered energy for all uses												8632.0928 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7817.4553	3.4800	272.0474 (240)
Space heating - secondary	1212.0397	4.2300	51.2693 (242)
Water heating (other fuel)	1307.5012	3.4800	45.5010 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	557.8098	13.1900	73.5751 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-2387.7132	13.1900	-314.9394 (252)
Total energy cost			263.9410 (255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

 11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.5096 (257)
SAP value		92.8910
SAP rating (Section 12)		93 (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	7817.4553	0.2160	1688.5703 (261)
Space heating - secondary	1212.0397	0.0190	23.0288 (263)
Water heating (other fuel)	1307.5012	0.2160	282.4203 (264)
Space and water heating			1994.0194 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	557.8098	0.5190	289.5033 (268)
Energy saving/generation technologies			
PV Unit	-2387.7132	0.5190	-1239.2231 (269)
Total kg/year			1109.1745 (272)
CO2 emissions per m2			6.4300 (273)
EI value			93.1674
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m2)	Storey height (m)	Volume (m3)
Ground floor	79.9400 (1b)	2.5200 (2b)	201.4488 (1b) - (3b)
First floor	92.5900 (1c)	2.6400 (2c)	244.4376 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	172.5300		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 445.8864 (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) =	0.0897 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3397 (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) =		0.3397 (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	0.3482	0.3227	0.3312	0.3142	0.3057	0.2803	0.2803	0.2718	0.2718	0.2888	0.2803	0.3142 (22b)
	0.5606	0.5521	0.5549	0.5494	0.5467	0.5393	0.5393	0.5369	0.5369	0.5417	0.5393	0.5494 (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)			27.4500	1.3258	36.3920		(27)
Garage Door			2.1000	1.4000	2.9400		(26)
Lantern Rooflight (Uw = 1.40)			1.8000	1.3258	2.3864		(27a)
Ground Floor			55.3500	0.1200	6.6420	75.0000	4151.2500 (28a)
Exposed Floor			24.5900	0.1500	3.6885	20.0000	491.8000 (28b)
External Walls	197.7300	29.4200	168.3100	0.1800	30.2958	60.0000	10098.6000 (29a)
Dormer Walls	9.2400	2.4600	6.7800	0.1700	1.1526	9.0000	61.0200 (29a)
Bay Roof	2.3100		2.3100	0.1500	0.3465	9.0000	20.7900 (30)
Flat Roof	9.6400	1.8000	7.8400	0.1400	1.0976	9.0000	70.5600 (30)
Pitched Cold Roof	67.9900		67.9900	0.1000	6.7990	9.0000	611.9100 (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)			395.8900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	98.8527		(33)
Party Walls			10.5600	0.0000	0.0000	70.0000	739.2000 (32)
Internal Wall Masonry			40.0500			75.0000	3003.7500 (32c)
Internal Wall Timber			163.9400			9.0000	1475.4600 (32c)
Internal Floor			67.9900			18.0000	1223.8200 (32d)
Internal Ceiling			67.9900			18.0000	1223.8200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23433.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							135.8218 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							38.6048 (36)
Total fabric heat loss						(33) + (36) =	137.4575 (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	82.4914	81.2337	81.6423	80.8358	80.4484	79.3500	79.3500	79.0050	79.0050	79.7055	79.3500	80.8358 (38)
Average = Sum(39)m / 12 =	219.9489	218.6912	219.0998	218.2933	217.9059	216.8075	216.8075	216.4625	216.4625	217.1630	216.8075	218.2933 (39)
												217.7286 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2748	1.2676	1.2699	1.2652	1.2630	1.2566	1.2566	1.2546	1.2546	1.2587	1.2566	1.2652 (40)
HLP (average)												1.2620 (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 FOR IMPROVED DWELLING 09 Jan 2014

Assumed occupancy												2.9659 (42)
Average daily hot water use (litres/day)												104.6413 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy content (annual)	115.1054	110.9198	106.7341	102.5485	98.3628	94.1772	94.1772	98.3628	102.5485	106.7341	110.9198	115.1054 (44)
Distribution loss (46)m = 0.15 x (45)m	170.6980	149.2936	154.0576	134.3111	128.8747	111.2091	103.0516	118.2532	119.6655	139.4586	152.2300	165.3119 (45)
												Total = Sum(45)m = 1646.4149 (45)
Water storage loss:	25.6047	22.3940	23.1086	20.1467	19.3312	16.6814	15.4577	17.7380	17.9498	20.9188	22.8345	24.7968 (46)
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	20.9848	18.9540	20.9848	20.3079	20.9848	20.3079	20.9848	20.9848	20.3079	20.9848	20.3079	20.9848 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	214.9452	189.2588	196.9090	170.3774	160.3276	141.4222	134.2718	150.4039	157.0825	182.3101	195.0498	209.5591 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1190.5240 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2000.0804 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2148 (H8)
Utilisation factor												0.5610 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												104.6413 (H14)
Volume ratio Veff/V												1.1038 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-986.5440 (H17)
Solar input	-32.7091	-46.5045	-79.1633	-106.4924	-124.6877	-133.4012	-129.2509	-115.8842	-91.4099	-63.3544	-37.7854	-25.9009 (63)
												Solar input (sum of months) = Sum(63)m = -986.5440 (63)
Output from w/h	182.2361	142.7542	117.7457	63.8850	35.6399	8.0210	5.0209	34.5197	65.6726	118.9556	157.2644	183.6582 (64)
												Total per year (kWh/year) = Sum(64)m = 1115.3735 (64)
Heat gains from water heating, kWh/month	92.1548	81.6123	85.5053	73.5115	68.0131	61.1475	59.2408	65.0398	69.7224	80.6511	84.8724	90.3640 (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	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569	177.9569 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	78.9637	70.1349	57.0375	43.1811	32.2784	27.2508	29.4454	38.2743	51.3716	65.2281	76.1308	81.1584 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	513.6137	518.9434	505.5127	476.9204	440.8277	406.9057	384.2437	378.9140	392.3447	420.9370	457.0297	490.9517 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616	55.7616 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380	-118.6380 (71)
Water heating gains (Table 5)	123.8640	121.4468	114.9265	102.0992	91.4155	84.9271	79.6248	87.4191	96.8366	108.4021	117.8783	121.4569 (72)
Total internal gains	831.5221	825.6058	792.5574	737.2814	679.6022	634.1642	608.3945	619.6879	655.6335	709.6478	766.1194	808.6477 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains
	m2	Table 6a	Specific data	Specific data	factor	W
		W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast	3.7800	14.6223	0.6300	0.7000	0.7700	16.8920 (75)
Southeast	10.7200	45.2918	0.6300	0.7000	0.7700	148.3836 (77)
Southwest	1.3400	45.2918	0.6300	0.7000	0.7700	18.5479 (79)
Northwest	11.6100	14.6223	0.6300	0.7000	0.7700	51.8825 (81)
North	1.8000	34.0000	0.6300	0.7000	1.0000	24.2903 (82)
Solar gains	259.9962	404.6861	623.4369	887.8836	1035.3728	1161.4125
Total gains	1091.5183	1230.2919	1415.9943	1625.1650	1714.9750	1795.5767
						1690.4266
						1565.8544
						1405.0336
						1206.7024
						1075.1704
						206.8899 (83)
						1015.5376 (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	29.5944	29.7646	29.7091	29.8189	29.8719	30.0232	30.0232	30.0711	30.0711	29.9741	30.0232	29.8189
alpha	2.9730	2.9843	2.9806	2.9879	2.9915	3.0015	3.0015	3.0047	3.0047	2.9983	3.0015	2.9879
util living area												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	0.9785	0.9680	0.9408	0.8790	0.7690	0.5831	0.4256	0.4757	0.7265	0.9058	0.9650	0.9822 (86)
MIT	19.3972	19.5640	19.8782	20.2677	20.6069	20.8201	20.8860	20.8757	20.7246	20.3091	19.8060	19.3663 (87)
Th 2	19.8606	19.8663	19.8645	19.8682	19.8699	19.8750	19.8750	19.8765	19.8765	19.8733	19.8750	19.8682 (88)
util rest of house												
	0.9741	0.9614	0.9279	0.8517	0.7135	0.4885	0.2986	0.3457	0.6438	0.8779	0.9563	0.9784 (89)
MIT 2	17.7352	17.9802	18.4302	18.9793	19.4312	19.6788	19.7344	19.7305	19.5884	19.0530	18.3392	17.6958 (90)
Living area fraction									fLA = Living area / (4) =			0.1137 (91)
MIT	17.9242	18.1603	18.5949	19.1258	19.5649	19.8086	19.8654	19.8607	19.7176	19.1958	18.5060	17.8858 (92)
Temperature adjustment												0.0000
adjusted MIT	17.9242	18.1603	18.5949	19.1258	19.5649	19.8086	19.8654	19.8607	19.7176	19.1958	18.5060	17.8858 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9634	0.9476	0.9091	0.8297	0.6962	0.4824	0.2974	0.3437	0.6301	0.8562	0.9416	0.9690 (94)
Useful gains	1051.5623	1165.8599	1287.3355	1348.3552	1193.9331	866.1166	502.7907	538.2437	885.3500	1033.1842	1012.4270	984.0829 (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	2842.6631	2746.8351	2474.7072	2057.5909	1495.8976	934.1322	512.8322	554.3008	1042.8368	1671.2498	2277.7822	2812.8862 (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	1332.5790	1062.4153	883.4045	510.6498	224.6616	0.0000	0.0000	0.0000	0.0000	474.7208	911.0557	1360.6296 (98)
Space heating												6760.1163 (98)
Space heating per m2												(98) / (4) = 39.1823 (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												6707.9434 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1332.5790	1062.4153	883.4045	510.6498	224.6616	0.0000	0.0000	0.0000	0.0000	474.7208	911.0557	1360.6296 (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)	1322.2945	1054.2158	876.5866	506.7087	222.9277	0.0000	0.0000	0.0000	0.0000	471.0570	904.0244	1350.1286 (211)
Water heating requirement	205.0122	163.4485	135.9084	78.5615	34.5633	0.0000	0.0000	0.0000	0.0000	73.0340	140.1624	209.3276 (215)
Water heating requirement	182.2361	142.7542	117.7457	63.8850	35.6399	8.0210	5.0209	34.5197	65.6726	118.9556	157.2644	183.6582 (64)
Efficiency of water heater (217)m	89.1276	89.1510	89.1617	89.2433	88.9179	80.0000	80.0000	80.0000	80.0000	88.1328	88.7889	89.1450 (217)
Fuel for water heating, kWh/month	204.4666	160.1263	132.0586	71.5852	40.0818	10.0263	6.2762	43.1496	82.0908	134.9732	177.1218	206.0219 (219)
Water heating fuel used												1267.9782 (219)
Annual totals kWh/year												
Space heating fuel - main system												6707.9434 (211)
Space heating fuel - secondary												1040.0179 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												125.0000 (231)
Electricity for lighting (calculated in Appendix L)												557.8098 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.90 * 1139 * 1.00) =										-2642.6853		-2642.6853 (233)
Total delivered energy for all uses												7056.0639 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6707.9434	9.7400	653.3537 (240)
Space heating - secondary	1040.0179	10.2500	106.6018 (242)
Water heating (other fuel)	1267.9782	9.7400	123.5011 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Pump for solar water heating	50.0000	36.8500	18.4250 (249)
Energy for lighting	557.8098	36.8500	205.5529 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-2642.6853	36.8500	-973.8295 (252)
Total energy cost			265.2425 (255)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6707.9434	0.2160	1448.9158 (261)
Space heating - secondary	1040.0179	0.0190	19.7603 (263)
Water heating (other fuel)	1267.9782	0.2160	273.8833 (264)
Space and water heating			1742.5594 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	557.8098	0.5190	289.5033 (268)
Energy saving/generation technologies			
PV Unit	-2642.6853	0.5190	-1371.5537 (269)
Total kg/year			725.3840 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	6707.9434	1.2200	8183.6909 (261)
Space heating - secondary	1040.0179	1.0400	1081.6186 (263)
Water heating (other fuel)	1267.9782	1.2200	1546.9334 (264)
Space and water heating			10812.2429 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	557.8098	3.0700	1712.4761 (268)
Energy saving/generation technologies			
PV Unit	-2642.6853	3.0700	-8113.0440 (269)
Primary energy kWh/year			4795.4249 (272)
Primary energy kWh/m2/year			27.7947 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	135.8 (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	1177.14 (P1)
Transmission heat loss coefficient	137.46 (37)
Summer heat loss coefficient	1314.60 (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	1.000	1.00	1.000	1.000 (P8)
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	3.7800	106.0502	0.6300	0.7000	0.9000	143.1947
South East	10.7200	127.3119	0.6300	0.7000	0.9000	487.5142
South West	1.3400	127.3119	0.6300	0.7000	0.9000	60.9393
North West	11.6100	106.0502	0.6300	0.7000	0.9000	439.8123
North	1.8000	217.0000	0.6300	0.7000	1.0000	155.0291

total: 1286.4896

	Jun	Jul	Aug
Solar gains	1389	1286	1120 (P3)
Internal gains	661	635	645
Total summer gains	2050	1921	1765 (P5)
Summer gain/loss ratio	1.56	1.46	1.34 (P6)
Summer external temperature	15.40	17.30	17.30

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Thermal mass temperature increment (TMP = 135.8)	1.05	1.05	1.05	
Threshold temperature	18.01	19.81	19.69	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
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Assessment of likelihood of high internal temperature:	Not significant			
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PREDICTED ENERGY ASSESSMENT

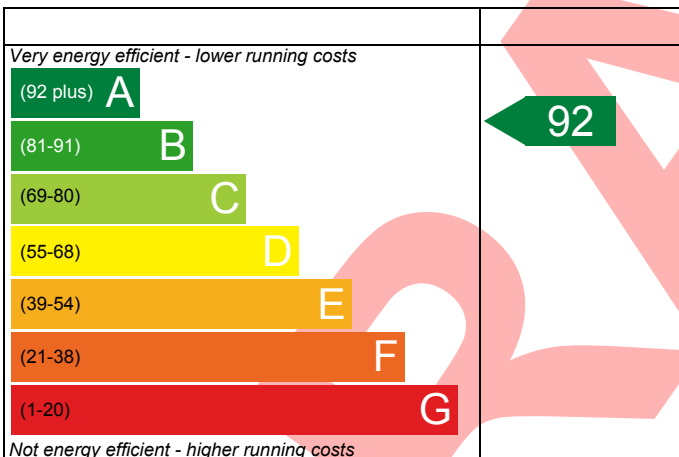
Tree House, Larg Drive,
Winchester,
Hampshire,
SO22 6NU

Dwelling type: House, Semi-Detached
Date of assessment: 01/03/2023
Produced by: Scott Spearing
Total floor area: 172.53 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.

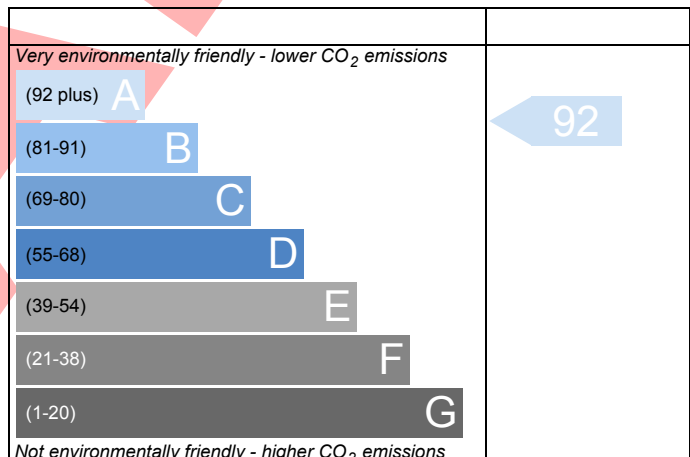
Energy Efficiency Rating



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.