

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-P637-6633-656				Issued on Date	31/05/2023
Assessment Reference	As Built	Prop Type Ref	Bowyer Bay-CB-As-DET			
Property	2, Kittiwake Place, BOTLEY, SO32 2ZB					
SAP Rating	89 B	DER	12.25	TER	18.42	
Environmental	90 B	% DER<TER	33.50			
CO ₂ Emissions (t/year)	0.86	DFEE	50.97	TFEE	60.04	
General Requirements Compliance	Pass	% DFEE<TFEE	15.10			
Assessor Details	Miss Maja Stanisz, Maja Stanisz, Tel: 01392 581 875, maja.stanisz@aessc.co.uk				Assessor ID	Q919-0001
Client						

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

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DWELLING AS BUILT

Detached House, total floor area 96 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) 18.42 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.25 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)60.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)51.0 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.26 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.13 (max. 0.25)	0.13 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.26 (max. 2.00)	1.30 (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:	4.72 (measured in this dwelling)	
Maximum	10.0	OK

4 Heating efficiency

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

Data from database

Ideal LOGIC HEAT H12

Efficiency: 89.4% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.26 kWh/day	
Permitted by DBSCG 1.89	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 (Thames Valley): Medium OK

Based on:

Overshading:	Average
Windows facing North East:	9.24 m ² , No overhang
Windows facing South East:	4.10 m ² , No overhang
Windows facing South West:	12.91 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Door U-value	0.64 W/m ² K
Photovoltaic array	1.48 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =	0.4437 (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	0.5658	0.5547	0.5436	0.4881	0.4770	0.4215	0.4215	0.4104	0.4437	0.4770	0.4992	0.5214 (22b)
Effective ac	0.6600	0.6538	0.6477	0.6191	0.6138	0.5888	0.5888	0.5842	0.5984	0.6138	0.6246	0.6359 (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
Solid Door			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (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	52.4275	51.9339	51.4500	49.1774	48.7522	46.7728	46.7728	46.4063	47.5352	48.7522	49.6124	50.5116 (38)
Average = Sum(39)m / 12 =	140.9266	140.4330	139.9492	137.6766	137.2514	135.2720	135.2720	134.9054	136.0344	137.2514	138.1115	139.0108 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4637	1.4586	1.4536	1.4300	1.4255	1.4050	1.4050	1.4012	1.4129	1.4255	1.4345	1.4438 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180	(44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204	(45)
Energy content (annual)										Total =	Sum(45)m =	1547.9009	(45)
Distribution loss	(46)m =	0.15 x	(45)m										
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131	(46)
Water storage loss:													
Store volume													
a) If manufacturer declared loss factor is known (kWh/day):												150.0000	(47)
Temperature factor from Table 2b												1.2600	(48)
Enter (49) or (54) in (55)												0.5400	(49)
Total storage loss												0.6804	(55)
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(56)
If cylinder contains dedicated solar storage													
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) =	Sum(63)m =			0.0000	(63)
Output from w/h													
	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(64)
								Total per year (kWh/year) =	Sum(64)m =			2070.1429	(64)
Heat gains from water heating, kWh/month													
	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611	(66)

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	813.7677	618.9490	504.8027	283.5761	131.3598	0.0000	0.0000	0.0000	0.0000	291.4793	567.5959	832.0042 (98)
Space heating												4043.5346 (98)
Space heating per m2										(98) / (4) =		41.9977 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4472.9365 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	813.7677	618.9490	504.8027	283.5761	131.3598	0.0000	0.0000	0.0000	0.0000	291.4793	567.5959	832.0042 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	900.1855	684.6781	558.4100	313.6904	145.3095	0.0000	0.0000	0.0000	0.0000	322.4329	627.8716	920.3586 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Efficiency of water heater (217)m	88.0235	87.7413	87.2082	86.0813	84.1047	79.7000	79.7000	79.7000	79.7000	86.0584	87.5001	79.7000 (216)
Fuel for water heating, kWh/month	232.7094	205.6306	216.9455	196.5566	196.8002	185.0425	177.2149	195.1471	195.0179	203.8951	212.6230	226.7348 (219)
Water heating fuel used												2444.3174 (219)
Annual totals kWh/year												
Space heating fuel - main system												4472.9365 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												393.8748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =												-1074.8994 (233)
Total delivered energy for all uses												6311.2293 (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	4472.9365	0.2160	966.1543 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2444.3174	0.2160	527.9726 (264)
Space and water heating			1494.1268 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total CO2, kg/year			1179.6000 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2500 (273)

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

DER		12.2500 ZC1
Total Floor Area	TFA	96.2800
Assumed number of occupants	N	2.7023
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.3973 ZC2
CO2 emissions from cooking, equation (L16)		1.9096 ZC3
Total CO2 emissions		29.5569 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		29.5569 ZC8

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1246 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3746 (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) =					0.3746	(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	0.4777	0.4683	0.4589	0.4121	0.4027	0.3559	0.3559	0.3465	0.3746	0.4027	0.4215	0.4402	(22b)				
Effective ac	0.6141	0.6097	0.6053	0.5849	0.5811	0.5633	0.5633	0.5600	0.5702	0.5811	0.5888	0.5969	(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			2.0300	1.0000	2.0300		(26)					
TER Semi-glazed door			2.0300	1.2000	2.4360		(26a)					
TER Opening Type (Uw = 1.40)			19.9900	1.3258	26.5019		(27)					
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582		(28a)					
EW Brick AAC011	131.1700	14.4200	116.7500	0.1800	21.0150		(29a)					
EW Brick AAC018	25.2800	9.6300	15.6500	0.1800	2.8170		(29a)					
PR 400mm MW044	48.1400		48.1400	0.1300	6.2582		(30)					
Total net area of external elements Aum(A, m2)			252.7300				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3163		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.6334 (36)					
Total fabric heat loss						(33) + (36) =	79.9497 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.7770	Feb 48.4251	Mar 48.0802	Apr 46.4602	May 46.1571	Jun 44.7462	Jul 44.7462	Aug 44.4849	Sep 45.2897	Oct 46.1571	Nov 46.7703	Dec 47.4113 (38)
Heat transfer coeff	128.7267	128.3748	128.0299	126.4099	126.1068	124.6959	124.6959	124.4346	125.2394	126.1068	126.7200	127.3610 (39)
Average = Sum(39)m / 12 =												126.4085 (39)
HLP	Jan 1.3370	Feb 1.3333	Mar 1.3298	Apr 1.3129	May 1.3098	Jun 1.2951	Jul 1.2951	Aug 1.2924	Sep 1.3008	Oct 1.3098	Nov 1.3162	Dec 1.3228 (40)
HLP (average)												1.3129 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Energy content (annual)												1547.9009 (45)
Distribution loss	Total = Sum(45)m = 1547.9009 (45)											
(46)m = 0.15 x (45)m												
24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)	
Water storage loss:												
Store volume												150.0000 (47)

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a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)
Total storage loss	
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)	
If cylinder contains dedicated solar storage	
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (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	
207.0791 182.4462 191.4344 171.3664 167.7584 149.6467 143.4803 157.7724 157.5971 177.7089 188.2131 202.0153 (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	
207.0791 182.4462 191.4344 171.3664 167.7584 149.6467 143.4803 157.7724 157.5971 177.7089 188.2131 202.0153 (64)	
Heat gains from water heating, kWh/month	
90.6369 80.3384 85.4351 78.0598 77.5628 70.8380 69.4903 74.2424 73.4815 80.8713 83.6613 88.9532 (65)	

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

Metabolic gains (Table 5), Watts	
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec	
(66)m 135.1159 135.1159 135.1159 135.1159 135.1159 135.1159 135.1159 135.1159 135.1159 135.1159 135.1159 135.1159 (66)	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	
22.3829 19.8803 16.1678 12.2400 9.1496 7.7245 8.3465 10.8492 14.5617 18.4894 21.5799 23.0050 (67)	
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	
250.1698 252.7658 246.2240 232.2973 214.7174 198.1947 187.1565 184.5606 191.1024 205.0290 222.6090 239.1316 (68)	
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	
36.5116 36.5116 36.5116 36.5116 36.5116 36.5116 36.5116 36.5116 36.5116 36.5116 36.5116 36.5116 (69)	
Pumps, fans	3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	
-108.0927 -108.0927 -108.0927 -108.0927 -108.0927 -108.0927 -108.0927 -108.0927 -108.0927 -108.0927 -108.0927 -108.0927 (71)	
Water heating gains (Table 5)	
121.8238 119.5513 114.8321 108.4163 104.2510 98.3861 93.4010 99.7882 102.0576 108.6980 116.1962 119.5608 (72)	
Total internal gains	
460.9113 458.7321 443.7586 419.4884 394.6527 370.8400 355.4388 361.7327 374.2564 398.7513 426.9199 448.2322 (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	7.0300	11.2829	0.6300	0.7000	0.7700	24.2409 (75)
Southeast	3.1200	36.7938	0.6300	0.7000	0.7700	35.0834 (77)
Southwest	9.8400	36.7938	0.6300	0.7000	0.7700	110.6476 (79)
Solar gains	169.9719	297.5769	428.5449	566.8361	667.6242	677.1890 646.8929 569.5000 476.0897 334.6524 205.0535 144.5117 (83)
Total gains	630.8832	756.3090	872.3035	986.3245	1062.2769	1048.0290 1002.3317 931.2327 850.3461 733.4037 631.9734 592.7439 (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 51.9404 52.0827 52.2230 52.8923 53.0194 53.6193 53.6193 53.7319 53.3867 53.0194 52.7629 52.4973	
alpha 4.4627 4.4722 4.4815 4.5262 4.5346 4.5746 4.5746 4.5821 4.5591 4.5346 4.5175 4.4998	
util living area	
0.9970 0.9929 0.9817 0.9465 0.8574 0.6946 0.5311 0.5874 0.8267 0.9671 0.9937 0.9978 (86)	
MIT 19.5655 19.7579 20.0554 20.4354 20.7516 20.9334 20.9845 20.9759 20.8470 20.4292 19.9269 19.5359 (87)	
Th 2 19.8120 19.8148 19.8176 19.8307 19.8332 19.8446 19.8446 19.8468 19.8402 19.8332 19.8282 19.8230 (88)	
util rest of house	
0.9960 0.9904 0.9751 0.9263 0.8047 0.5948 0.3998 0.4534 0.7453 0.9507 0.9911 0.9970 (89)	
MIT 2 17.9213 18.2033 18.6356 19.1813 19.5959 19.8020 19.8393 19.8374 19.7218 19.1847 18.4601 17.8855 (90)	
Living area fraction	
fLA = Living area / (4) =	0.1598 (91)
MIT 18.1841 18.4518 18.8625 19.3817 19.7807 19.9828 20.0224 20.0194 19.9016 19.3836 18.6946 18.1493 (92)	
Temperature adjustment	0.0000
adjusted MIT 18.1841 18.4518 18.8625 19.3817 19.7807 19.9828 20.0224 20.0194 19.9016 19.3836 18.6946 18.1493 (93)	

8. Space heating requirement

Utilisation	Jan 0.9938	Feb 0.9862	Mar 0.9677	Apr 0.9165	May 0.8019	Jun 0.6077	Jul 0.4208	Aug 0.4745	Sep 0.7503	Oct 0.9420	Nov 0.9873	Dec 0.9952 (94)
Useful gains	626.9555	745.8957	844.1138	903.9230	851.8254	636.9251	421.7823	441.8946	638.0244	690.8565	623.9307	589.9096 (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	1787.2539	1739.7134	1582.7746	1324.9940	1019.0279	671.2185	426.7549	450.3776	726.5945	1107.6702	1469.2658	1776.6008 (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	863.2620	667.8455	549.5637	303.1712	124.3987	0.0000	0.0000	0.0000	0.0000	310.1094	608.6413	882.8983 (98)
Space heating												4309.8899 (98)
Space heating per m2												(98) / (4) = 44.7641 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4609.5080 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	863.2620	667.8455	549.5637	303.1712	124.3987	0.0000	0.0000	0.0000	0.0000	310.1094	608.6413	882.8983	(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)	923.2749	714.2732	587.7686	324.2472	133.0467	0.0000	0.0000	0.0000	0.0000	331.6678	650.9532	944.2763	(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	207.0791	182.4462	191.4344	171.3664	167.7584	149.6467	143.4803	157.7724	157.5971	177.7089	188.2131	202.0153	(64)
Efficiency of water heater (217)m	88.2117	87.9691	87.4700	86.3203	84.0303	79.8000	79.8000	79.8000	79.8000	86.2853	87.7218	79.8000	(216)
Fuel for water heating, kWh/month	234.7526	207.3981	218.8572	198.5240	199.6403	187.5272	179.7999	197.7097	197.4901	205.9551	214.5567	228.7945	(219)
Water heating fuel used												2471.0055	(219)
Annual totals kWh/year													
Space heating fuel - main system												4609.5080	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												395.2898	(232)
Total delivered energy for all uses												7550.8032	(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	4609.5080	0.2160	995.6537	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2471.0055	0.2160	533.7372	(264)
Space and water heating			1529.3909	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	395.2898	0.5190	205.1554	(268)
Total CO2, kg/m2/year			1773.4713	(272)
Emissions per m2 for space and water heating			15.8848	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.1308	(272b)
Emissions per m2 for pumps and fans			0.4043	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8848 * 1.00) + 2.1308 + 0.4043, rounded to 2 d.p.			18.4200	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1246 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.3606 (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) =	0.3606 (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	0.4598	0.4508	0.4418	0.3967	0.3877	0.3426	0.3426	0.3336	0.3606	0.3877	0.4057	0.4237 (22b)
Effective ac	0.6057	0.6016	0.5976	0.5787	0.5751	0.5587	0.5587	0.5556	0.5650	0.5751	0.5823	0.5898 (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
Solid Door			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (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	48.1124	47.7864	47.4667	45.9656	45.6847	44.3772	44.3772	44.1351	44.8808	45.6847	46.2529	46.8469 (38)
Average = Sum(39)m / 12 =	136.6116	136.2855	135.9659	134.4647	134.1839	132.8764	132.8764	132.6343	133.3800	134.1839	134.7521	135.3461 (39)
	134.4634 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4189	1.4155	1.4122	1.3966	1.3937	1.3801	1.3801	1.3776	1.3853	1.3937	1.3996	1.4058 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	34.1029	29.8266	30.7784	26.8333	25.7472	22.2179	20.5882	23.6252	23.9074	27.8617	30.4133	33.0268 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3028	19.8092	16.1099	12.1962	9.1168	7.6968	8.3167	10.8103	14.5096	18.4233	21.5027	22.9227	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	(71)
Water heating gains (Table 5)	45.8372	44.3848	41.3688	37.2685	34.6065	30.8582	27.6723	31.7543	33.2047	37.4486	42.2406	44.3909	(72)
Total internal gains	381.8446	380.4945	367.2374	345.2968	321.9754	300.2845	286.6802	290.6600	302.3514	324.4356	349.8870	369.9800	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	9.2400	11.2829	0.4600	0.0000	0.7700	36.9269	(75)
Southeast	4.1000	36.7938	0.4600	0.0000	0.7700	53.4327	(77)
Southwest	2.9400	36.7938	0.4600	0.0000	0.7700	38.3152	(79)
Southwest	9.9700	36.7938	0.4600	0.0000	0.7700	129.9328	(79)

Solar gains	258.6076	452.7700	652.0794	862.5666	1015.9906	1030.5683	984.4537	866.6406	724.4449	509.1917	311.9860	219.8689	(83)
Total gains	640.4522	833.2646	1019.3169	1207.8634	1337.9660	1330.8527	1271.1339	1157.3005	1026.7963	833.6273	661.8730	589.8488	(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	27.2088	27.2739	27.3380	27.6432	27.7011	27.9736	27.9736	28.0247	27.8680	27.7011	27.5843	27.4632	
alpha	2.8139	2.8183	2.8225	2.8429	2.8467	2.8649	2.8649	2.8683	2.8579	2.8467	2.8390	2.8309	
util living area	0.9797	0.9585	0.9184	0.8380	0.7137	0.5613	0.4317	0.4838	0.6990	0.8923	0.9656	0.9837	(86)
MIT	18.6883	19.0478	19.5504	20.1356	20.5878	20.8540	20.9493	20.9291	20.7143	20.0831	19.2667	18.6248	(87)
Th 2	19.7489	19.7515	19.7540	19.7659	19.7682	19.7786	19.7786	19.7806	19.7746	19.7682	19.7637	19.7589	(88)
util rest of house	0.9754	0.9501	0.9019	0.8055	0.6575	0.4761	0.3227	0.3714	0.6200	0.8628	0.9573	0.9802	(89)
MIT 2	17.6723	18.0275	18.5181	19.0797	19.4827	19.7017	19.7614	19.7543	19.6050	19.0493	18.2566	17.6165	(90)
Living area fraction	17.8347	18.1906	18.6831	19.2485	19.6593	19.8859	19.9513	19.9421	19.7823	19.2146	18.4180	17.7777	(91)
MIT	17.8347	18.1906	18.6831	19.2485	19.6593	19.8859	19.9513	19.9421	19.7823	19.2146	18.4180	17.7777	(92)
Temperature adjustment	17.8347	18.1906	18.6831	19.2485	19.6593	19.8859	19.9513	19.9421	19.7823	19.2146	18.4180	17.7777	(93)
adjusted MIT	17.8347	18.1906	18.6831	19.2485	19.6593	19.8859	19.9513	19.9421	19.7823	19.2146	18.4180	17.7777	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9663	0.9362	0.8842	0.7896	0.6520	0.4841	0.3389	0.3872	0.6205	0.8464	0.9448	0.9724	(94)
Ext temp.	618.8833	780.0786	901.2935	953.7603	872.3159	644.3059	430.7239	448.1165	637.1367	705.5411	625.3652	573.5886	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1848.9986	1811.3189	1656.4846	1391.5091	1068.0142	702.3705	445.3090	469.8035	757.9030	1155.9386	1525.1296	1837.6818	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	915.2057	692.9935	561.8622	315.1791	145.5995	0.0000	0.0000	0.0000	0.0000	335.0957	647.8304	940.4853	(98)
Space heating per m2												4554.2515	(98)
										(98) / (4) =		47.3022	(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 Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1249.0380	983.2853	1008.0204	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8354	0.8854	0.8586	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1043.4443	870.5866	865.5198	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1658.4361	1586.4248	1455.1627	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	442.7941	532.5836	438.6943	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1414.0720	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	110.6985	133.1459	109.6736	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												353.5180	(107)
Energy for space heating												3.6718	(108)
Energy for space cooling												47.3022	(99)
Total												3.6718	(108)
Dwelling Fabric Energy Efficiency (DFEE)												50.9739	(109)
												51.0	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1246 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3746 (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) =	0.3746 (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	0.4777	0.4683	0.4589	0.4121	0.4027	0.3559	0.3559	0.3465	0.3746	0.4027	0.4215	0.4402 (22b)
Effective ac	0.6141	0.6097	0.6053	0.5849	0.5811	0.5633	0.5633	0.5600	0.5702	0.5811	0.5888	0.5969 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0300	1.0000	2.0300		(26)
TER Semi-glazed door			2.0300	1.2000	2.4360		(26a)
TER Opening Type (Uw = 1.40)			19.9900	1.3258	26.5019		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582		(28a)
EW Brick AAC011	131.1700	14.4200	116.7500	0.1800	21.0150		(29a)
EW Brick AAC018	25.2800	9.6300	15.6500	0.1800	2.8170		(29a)
PR 400mm MW044	48.1400		48.1400	0.1300	6.2582		(30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3163		(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)							12.6334 (36)
Total fabric heat loss						(33) + (36) =	79.9497 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.7770	48.4251	48.0802	46.4602	46.1571	44.7462	44.7462	44.4849	45.2897	46.1571	46.7703	47.4113 (38)
Heat transfer coeff	128.7267	128.3748	128.0299	126.4099	126.1068	124.6959	124.6959	124.4346	125.2394	126.1068	126.7200	127.3610 (39)
Average = Sum(39)m / 12 =												126.4085 (39)
HLP	1.3370	1.3333	1.3298	1.3129	1.3098	1.2951	1.2951	1.2924	1.3008	1.3098	1.3162	1.3228 (40)
HLP (average)												1.3129 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
Daily hot water use	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy conte	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9009 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	34.1029	29.8266	30.7784	26.8333	25.7472	22.2179	20.5882	23.6252	23.9074	27.8617	30.4133	33.0268 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159	135.1159 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3829	19.8803	16.1678	12.2400	9.1496	7.7245	8.3465	10.8492	14.5617	18.4894	21.5799	23.0050 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.1698	252.7658	246.2240	232.2973	214.7174	198.1947	187.1565	184.5606	191.1024	205.0290	222.6090	239.1316 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116	36.5116 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	45.8372	44.3848	41.3688	37.2685	34.6065	30.8582	27.6723	31.7543	33.2047	37.4486	42.2406	44.3909 (72)
Total internal gains	381.9247	380.5657	367.2953	345.3406	322.0082	300.3121	286.7101	290.6988	302.4035	324.5018	349.9643	370.0623 (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					7.0300	11.2829	0.6300	0.7000	0.7700		24.2409 (75)	
Southeast					3.1200	36.7938	0.6300	0.7000	0.7700		35.0834 (77)	
Southwest					9.8400	36.7938	0.6300	0.7000	0.7700		110.6476 (79)	
Solar gains	169.9719	297.5769	428.5449	566.8361	667.6242	677.1890	646.8929	569.5000	476.0897	334.6524	205.0535	144.5117 (83)
Total gains	551.8966	678.1426	795.8402	912.1767	989.6324	977.5011	933.6030	860.1988	778.4932	659.1542	555.0178	514.5740 (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	51.9404	52.0827	52.2230	52.8923	53.0194	53.6193	53.6193	53.7319	53.3867	53.0194	52.7629	52.4973
alpha	4.4627	4.4722	4.4815	4.5262	4.5346	4.5746	4.5746	4.5821	4.5591	4.5346	4.5175	4.4998
util living area	0.9983	0.9954	0.9870	0.9587	0.8813	0.7289	0.5652	0.6270	0.8601	0.9775	0.9963	0.9988 (86)
MIT	19.4918	19.6862	19.9885	20.3795	20.7151	20.9187	20.9801	20.9686	20.8153	20.3676	19.8558	19.4626 (87)
Th 2	19.8120	19.8148	19.8176	19.8307	19.8332	19.8446	19.8446	19.8468	19.8402	19.8332	19.8282	19.8230 (88)
util rest of house	0.9977	0.9938	0.9822	0.9423	0.8336	0.6296	0.4280	0.4881	0.7860	0.9657	0.9947	0.9983 (89)
MIT 2	18.4477	18.6436	18.9454	19.3360	19.6430	19.8080	19.8398	19.8382	19.7386	19.3328	18.8238	18.4271 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	18.6146	18.8103	19.1122	19.5028	19.8144	19.9856	20.0221	20.0189	19.9107	19.4982	18.9888	18.5926 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6146	18.8103	19.1122	19.5028	19.8144	19.9856	20.0221	20.0189	19.9107	19.4982	18.9888	18.5926 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9968	0.9918	0.9783	0.9365	0.8327	0.6430	0.4501	0.5103	0.7914	0.9610	0.9930	0.9976 (94)
Ext temp.	550.1133	672.5767	778.5434	854.2115	824.1059	628.5024	420.1914	438.9491	616.1087	633.4368	551.1508	513.3549 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1842.6760	1785.7275	1614.7348	1340.3003	1023.2759	671.5586	426.7227	450.3119	727.7326	1122.1297	1506.5442	1833.0614 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating	961.6667	748.0373	622.1264	349.9839	148.1825	0.0000	0.0000	0.0000	0.0000	363.5875	687.8832	981.8616 (98)
Space heating per m2												4863.3292 (98)
										(98) / (4) =		50.5124 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1172.1413	922.7495	945.7029	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8446	0.9079	0.8792	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	989.9662	837.7295	831.4640	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1245.4645	1191.9479	1107.9527	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)

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Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	183.9587	263.5384	205.7076	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												653.2047 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	45.9897	65.8846	51.4269	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												163.3012 (107)
Energy for space heating												1.6961 (108)
Energy for space cooling												50.5124 (99)
Total												1.6961 (108)
Target Fabric Energy Efficiency (TFEE)												52.2085 (109)
												60.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =	0.4437 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.4659	0.4326	0.4437	0.4215	0.4215	0.4104	0.3994	0.3883	0.3772	0.4104	0.3883	0.4104 (22b)
	0.6085	0.5936	0.5984	0.5888	0.5888	0.5842	0.5797	0.5754	0.5711	0.5842	0.5754	0.5842 (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
Solid Door			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (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	48.3368	47.1491	47.5352	46.7728	46.7728	46.4063	46.0495	45.7025	45.3653	46.4063	45.7025	46.4063 (38)
Average = Sum(39)m / 12 =	136.8359	135.6483	136.0344	135.2720	135.2720	134.9054	134.5487	134.2017	133.8644	134.9054	134.2017	134.9054 (39)
												135.0496 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4212	1.4089	1.4129	1.4050	1.4050	1.4012	1.3975	1.3939	1.3904	1.4012	1.3939	1.4012 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy											
Average daily hot water use (litres/day)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6804 (55)
Total storage loss												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (56)
If cylinder contains dedicated solar storage												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =												0.0000 (63)
Output from w/h	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
												Total per year (kWh/year) = Sum (64)m =
												2070.1429 (64)
RHI water heating demand												2070 (64)
Heat gains from water heating, kWh/month												
	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	(71)
Water heating gains (Table 5)													
	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520	(72)
Total internal gains	659.5225	654.8904	631.1591	594.1732	556.0706	521.9949	502.0846	510.8314	532.1128	569.3235	610.7589	642.3342	(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				9.2400	14.6176		0.4600	0.0000		0.7700	47.8408 (75)	
Southeast				4.1000	45.1778		0.4600	0.0000		0.7700	65.6081 (77)	
Southwest				2.9400	45.1778		0.4600	0.0000		0.7700	47.0458 (79)	
Southwest				9.9700	45.1778		0.4600	0.0000		0.7700	159.5398 (79)	

Solar gains	320.0345	477.9111	697.3622	934.6518	1051.5316	1160.7343	1099.2813	987.9314	820.5284	580.8094	385.0301	267.3648 (83)
Total gains	979.5570	1132.8015	1328.5213	1528.8249	1607.6022	1682.7292	1601.3659	1498.7628	1352.6412	1150.1330	995.7891	909.6990 (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	27.1642	27.4020	27.3242	27.4782	27.4782	27.5529	27.6260	27.6974	27.7672	27.5529	27.6974	27.5529	
alpha	2.8109	2.8268	2.8216	2.8319	2.8319	2.8369	2.8417	2.8465	2.8511	2.8369	2.8465	2.8369	
util living area	0.9404	0.9137	0.8536	0.7454	0.6062	0.4287	0.3183	0.3376	0.5506	0.7815	0.9031	0.9483	(86)
MIT	19.2095	19.4661	19.9214	20.4164	20.7541	20.9331	20.9789	20.9756	20.8612	20.4436	19.7920	19.1804	(87)
Th 2	19.7471	19.7565	19.7535	19.7595	19.7595	19.7624	19.7653	19.7680	19.7707	19.7624	19.7680	19.7624	(88)
util rest of house	0.9290	0.8980	0.8275	0.7023	0.5415	0.3451	0.2215	0.2358	0.4642	0.7322	0.8822	0.9381	(89)
MIT 2	17.4524	17.8195	18.4503	19.1141	19.5304	19.7185	19.7571	19.7585	19.6657	19.1742	18.2964	17.4218	(90)
Living area fraction													
MIT	17.7333	18.0827	18.6855	19.3223	19.7261	19.9127	19.9524	19.9530	19.8568	19.3771	18.5355	17.7029	(92)
Temperature adjustment													
adjusted MIT	17.5833	17.9327	18.5355	19.1723	19.5761	19.7627	19.8024	19.8030	19.7068	19.2271	18.3855	17.5529	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9016	0.8677	0.7963	0.6791	0.5311	0.3451	0.2245	0.2388	0.4593	0.7070	0.8515	0.9125	(94)
Useful gains	883.1809	982.8820	1057.9409	1038.2476	853.8247	580.6854	359.4293	357.8814	621.2881	813.1505	847.8890	830.1391	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1735.5302	1713.6074	1569.2220	1308.3923	957.1914	602.0386	363.6033	362.7489	670.2310	1055.9215	1407.1664	1693.4544	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating kWh	634.1479	491.0474	380.3931	194.5042	76.9048	0.0000	0.0000	0.0000	0.0000	180.6216	402.6797	642.3066 (98)
Space heating												3002.6054 (98)
RHI space heating demand												3003 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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)					50.0000 / (5) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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)	=	0.4437 (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	0.5658	0.5547	0.5436	0.4881	0.4770	0.4215	0.4215	0.4104	0.4437	0.4770	0.4992	0.5214 (22b)
	0.6600	0.6538	0.6477	0.6191	0.6138	0.5888	0.5888	0.5842	0.5984	0.6138	0.6246	0.6359 (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
Solid Door			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (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	52.4275	51.9339	51.4500	49.1774	48.7522	46.7728	46.7728	46.4063	47.5352	48.7522	49.6124	50.5116 (38)
Average = Sum(39)m / 12 =	140.9266	140.4330	139.9492	137.6766	137.2514	135.2720	135.2720	134.9054	136.0344	137.2514	138.1115	139.0108 (39)
	137.6745 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4637	1.4586	1.4536	1.4300	1.4255	1.4050	1.4050	1.4012	1.4129	1.4255	1.4345	1.4438 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2600 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6804 (55)
Total storage loss												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (56)
If cylinder contains dedicated solar storage												
	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
Solar input	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Heat gains from water heating, kWh/month	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520 (72)
Total internal gains	659.5225	654.8904	631.1591	594.1732	556.0706	521.9949	502.0846	510.8314	532.1128	569.3235	610.7589	642.3342 (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				9.2400	11.2829	0.4600		0.0000		0.7700		36.9269 (75)
Southeast				4.1000	36.7938	0.4600		0.0000		0.7700		53.4327 (77)
Southwest				2.9400	36.7938	0.4600		0.0000		0.7700		38.3152 (79)
Southwest				9.9700	36.7938	0.4600		0.0000		0.7700		129.9328 (79)
Solar gains	258.6076	452.7700	652.0794	862.5666	1015.9906	1030.5683	984.4537	866.6406	724.4449	509.1917	311.9860	219.8689 (83)
Total gains	918.1301	1107.6604	1283.2386	1456.7397	1572.0612	1552.5632	1486.5383	1377.4720	1256.5578	1078.5152	922.7449	862.2031 (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	26.3757	26.4684	26.5599	26.9983	27.0820	27.4782	27.4782	27.5529	27.3242	27.0820	26.9133	26.7392
alpha	2.7584	2.7646	2.7707	2.7999	2.8055	2.8319	2.8319	2.8369	2.8216	2.8055	2.7942	2.7826
util living area	0.9532	0.9239	0.8744	0.7841	0.6565	0.5048	0.3819	0.4235	0.6235	0.8302	0.9285	0.9596 (86)
MIT	18.9577	19.2880	19.7435	20.2702	20.6590	20.8850	20.9614	20.9477	20.7828	20.2577	19.5204	18.9060 (87)
Th 2	19.7148	19.7187	19.7225	19.7404	19.7438	19.7595	19.7595	19.7624	19.7535	19.7438	19.7370	19.7299 (88)
util rest of house												
	0.9441	0.9098	0.8515	0.7457	0.5974	0.4226	0.2815	0.3197	0.5419	0.7903	0.9128	0.9518 (89)
MIT 2	17.0733	17.5441	18.1851	18.9113	19.4068	19.6735	19.7410	19.7353	19.5727	18.9209	17.8960	17.0083 (90)
Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.3745	17.8229	18.4342	19.1286	19.6069	19.8671	19.9361	19.9291	19.7661	19.1346	18.1556	17.3116 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2245	17.6729	18.2842	18.9786	19.4569	19.7171	19.7861	19.7791	19.6161	18.9846	18.0056	17.1616 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9189	0.8795	0.8190	0.7187	0.5825	0.4196	0.2837	0.3212	0.5319	0.7606	0.8833	0.9285 (94)
Useful gains	843.6381	974.1634	1050.9629	1046.9054	915.7100	651.4177	421.7239	442.4218	668.3741	820.3637	815.0598	800.5829 (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	1821.4040	1793.7315	1649.1860	1387.5802	1064.6517	692.2038	430.9886	455.8543	750.3812	1150.7964	1506.1932	1801.8052 (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												

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	727.4579	550.7498	445.0780	245.2858	110.8126	0.0000	0.0000	0.0000	0.0000	245.8419	497.6161	744.9094 (98)
Space heating												3567.7514 (98)
Space heating per m2											(98) / (4) =	37.0560 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3946.6277 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	727.4579	550.7498	445.0780	245.2858	110.8126	0.0000	0.0000	0.0000	0.0000	245.8419	497.6161	744.9094 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	804.7100	609.2365	492.3429	271.3339	122.5803	0.0000	0.0000	0.0000	0.0000	271.9490	550.4603	824.0148 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Efficiency of water heater (217)m	87.8098	87.5012	86.9192	85.7031	83.6715	79.7000	79.7000	79.7000	79.7000	85.6130	87.2137	79.7000 (216)
Fuel for water heating, kWh/month	233.2757	206.1947	217.6667	197.4241	197.8192	185.0425	177.2149	195.1471	195.0179	204.9558	213.3211	227.2644 (219)
Water heating fuel used												2450.3441 (219)
Annual totals kWh/year												
Space heating fuel - main system												3946.6277 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												393.8748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994 (233)
Total delivered energy for all uses												5790.9471 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3946.6277	3.4800	137.3426 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2450.3441	3.4800	85.2720 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	393.8748	13.1900	51.9521 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1074.8994	13.1900	-141.7792 (252)
Total energy cost			262.6800 (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] =	0.7809 (257)
SAP value		89.1064
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3946.6277	0.2160	852.4716 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2450.3441	0.2160	529.2743 (264)
Space and water heating			1381.7459 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			1067.2191 (272)
CO2 emissions per m2			11.0800 (273)
EI value			89.8777

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI rating 90 (274)
EI band B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9040 = 3.850$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9040 = 0.2389$, stars = 4
Water heating energy efficiency	$3.48 / 0.8426 = 4.130$, stars = 4
Water heating environmental impact	$0.216 / 0.8426 = 0.2563$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 240.7000 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =	0.4437 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.4659	0.4326	0.4437	0.4215	0.4215	0.4104	0.3994	0.3883	0.3772	0.4104	0.3883	0.4104 (22b)
	0.6085	0.5936	0.5984	0.5888	0.5888	0.5842	0.5797	0.5754	0.5711	0.5842	0.5754	0.5842 (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
Solid Door			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018		12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (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	48.3368	47.1491	47.5352	46.7728	46.7728	46.4063	46.0495	45.7025	45.3653	46.4063	45.7025	46.4063 (38)
Average = Sum(39)m / 12 =	136.8359	135.6483	136.0344	135.2720	135.2720	134.9054	134.5487	134.2017	133.8644	134.9054	134.2017	134.9054 (39)
												135.0496 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4212	1.4089	1.4129	1.4050	1.4050	1.4012	1.3975	1.3939	1.3904	1.4012	1.3939	1.4012 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180	(44)	
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204	(45)	
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1547.9009	(45)	
Water storage loss:	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131	(46)	
Store volume													150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.2600	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.6804	(55)
Total storage loss	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(56)	
If cylinder contains dedicated solar storage	21.0924	19.0512	21.0924	20.4120	21.0924	20.4120	21.0924	21.0924	20.4120	21.0924	20.4120	21.0924	(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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752	(64)	
Heat gains from water heating, kWh/month	88.8448	78.7198	83.6430	76.3255	75.7707	69.1037	67.6982	72.4503	71.7472	79.0793	81.9270	87.1611	(65)	
										Total per year (kWh/year) = Sum(64)m =		2070.1429	(64)	

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)	119.4151	117.1425	112.4233	106.0076	101.8423	95.9773	90.9923	97.3795	99.6489	106.2893	113.7875	117.1520 (72)
Total internal gains	659.5225	654.8904	631.1591	594.1732	556.0706	521.9949	502.0846	510.8314	532.1128	569.3235	610.7589	642.3342 (73)

[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	9.2400	14.6176	0.4600	0.0000	0.7700	47.8408 (75)
Southeast	4.1000	45.1778	0.4600	0.0000	0.7700	65.6081 (77)
Southwest	2.9400	45.1778	0.4600	0.0000	0.7700	47.0458 (79)
Southwest	9.9700	45.1778	0.4600	0.0000	0.7700	159.5398 (79)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	27.1642	27.4020	27.3242	27.4782	27.4782	27.5529	27.6260	27.6974	27.7672	27.5529	27.6974	27.5529
alpha	2.8109	2.8268	2.8216	2.8319	2.8319	2.8369	2.8417	2.8465	2.8511	2.8369	2.8465	2.8369
util living area												
	0.9404	0.9137	0.8536	0.7454	0.6062	0.4287	0.3183	0.3376	0.5506	0.7815	0.9031	0.9483 (86)
MIT	19.2095	19.4661	19.9214	20.4164	20.7541	20.9331	20.9789	20.9756	20.8612	20.4436	19.7920	19.1804 (87)
Th 2	19.7471	19.7565	19.7535	19.7595	19.7595	19.7624	19.7653	19.7680	19.7707	19.7624	19.7680	19.7624 (88)
util rest of house												
	0.9290	0.8980	0.8275	0.7023	0.5415	0.3451	0.2215	0.2358	0.4642	0.7322	0.8822	0.9381 (89)
MIT 2	17.4524	17.8195	18.4503	19.1141	19.5304	19.7185	19.7571	19.7585	19.6657	19.1742	18.2964	17.4218 (90)
Living area fraction												
MIT	17.7333	18.0827	18.6855	19.3223	19.7261	19.9127	19.9524	19.9530	19.8568	19.3771	18.5355	17.7029 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5833	17.9327	18.5355	19.1723	19.5761	19.7627	19.8024	19.8030	19.7068	19.2271	18.3855	17.5529 (93)

[illegible]

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Space heating	634.1479	491.0474	380.3931	194.5042	76.9048	0.0000	0.0000	0.0000	0.0000	180.6216	402.6797	642.3066 (98)
Space heating per m2												3002.6054 (98)
											(98) / (4) =	31.1862 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3321.4661 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	634.1479	491.0474	380.3931	194.5042	76.9048	0.0000	0.0000	0.0000	0.0000	180.6216	402.6797	642.3066 (98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000 (210)
Space heating fuel (main heating system)	701.4910	543.1941	420.7888	215.1595	85.0717	0.0000	0.0000	0.0000	0.0000	199.8027	445.4421	710.5161 (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	204.8390	180.4229	189.1943	169.1986	165.5183	147.4789	141.2402	155.5323	155.4293	175.4688	186.0452	199.7752 (64)
Efficiency of water heater (217)m	87.5309	87.2525	86.5408	85.0859	82.8094	79.7000	79.7000	79.7000	79.7000	84.7906	86.7208	79.7000 (216)
Fuel for water heating, kWh/month	234.0191	206.7826	218.6185	198.8563	199.8786	185.0425	177.2149	195.1471	195.0179	206.9436	214.5336	228.0289 (219)
Water heating fuel used												2460.0835 (219)
Annual totals kWh/year												
Space heating fuel - main system												3321.4661 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												393.8748 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.48 * 1031 * 1.00) =										-1220.7247		-1220.7247 (233)
Total delivered energy for all uses												5029.6997 (238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3321.4661	9.7400	323.5108 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2460.0835	9.7400	239.6121 (247)
Pumps and fans for heating	75.0000	36.8500	27.6375 (249)
Energy for lighting	393.8748	36.8500	145.1428 (250)
Additional standing charges			104.0000 (251)
Energy saving/generation technologies			
PV Unit	-1220.7247	36.8500	-449.8370 (252)
Total energy cost			390.0662 (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	3321.4661	0.2160	717.4367 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2460.0835	0.2160	531.3780 (264)
Space and water heating			1248.8147 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	0.5190	-633.5561 (269)
Total kg/year			858.6046 (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	3321.4661	1.2200	4052.1887 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2460.0835	1.2200	3001.3019 (264)
Space and water heating			7053.4906 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy for lighting	393.8748	3.0700	1209.1955 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	3.0700	-3747.6247 (269)
Primary energy kWh/year			4745.3114 (272)
Primary energy kWh/m2/year			49.2866 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 89
Current environmental impact rating: B 90

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.5	-£ 109	-257 kg (29.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£109 2.67 kg/m²	B 91	A 92
Total Savings	£109 2.67 kg/m²		

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

Fuel prices for cost data on this page from database revision number 516 TEST (28 Apr 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£173	£191	-£18
Mains gas	£667	£540	£127
Space heating	£455	£457	-£2
Water heating	£240	£129	£111
Lighting	£145	£145	£0
Generated (PV)	-£450	-£450	£0
Total cost of fuels	£390	£281	£109
Total cost of uses	£390	£281	£109
Delivered energy	52 kWh/m²	39 kWh/m²	13 kWh/m²
Carbon dioxide emissions	0.9 tonnes	0.6 tonnes	0.3 tonnes
CO2 emissions per m²	9 kg/m²	6 kg/m²	3 kg/m²
Primary energy	49 kWh/m²	34 kWh/m²	15 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =	0.4437 (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	0.5658	0.5547	0.5436	0.4881	0.4770	0.4215	0.4215	0.4104	0.4437	0.4770	0.4992	0.5214 (22b)
	0.6600	0.6538	0.6477	0.6191	0.6138	0.5888	0.5888	0.5842	0.5984	0.6138	0.6246	0.6359 (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
Solid Door			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018	25.2800	12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (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	52.4275	51.9339	51.4500	49.1774	48.7522	46.7728	46.7728	46.4063	47.5352	48.7522	49.6124	50.5116 (38)
Average = Sum(39)m / 12 =	140.9266	140.4330	139.9492	137.6766	137.2514	135.2720	135.2720	134.9054	136.0344	137.2514	138.1115	139.0108 (39)
												137.6745 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4637	1.4586	1.4536	1.4300	1.4255	1.4050	1.4050	1.4012	1.4129	1.4255	1.4345	1.4438 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4751 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7965 (55)
Total storage loss												
	24.6926	22.3030	24.6926	23.8961	24.6926	23.8961	24.6926	24.6926	23.8961	24.6926	23.8961	24.6926 (56)
If cylinder contains dedicated solar storage												
	14.9455	13.4992	14.9455	14.4634	14.9455	14.4634	14.9455	14.9455	14.4634	14.9455	14.4634	14.9455 (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												
	198.6922	174.8709	181.6517	156.4964	146.5771	128.9236	122.0664	137.2890	144.0778	167.9262	180.0967	193.6283 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1717 (H8)
Utilisation factor												0.5741 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												98.3800 (H14)
Volume ratio Veff/V												1.1130 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-915.4729 (H17)
Solar input	-26.5469	-44.2991	-75.4465	-101.1132	-124.9168	-122.8131	-121.1901	-105.8844	-82.9287	-56.6305	-31.4884	-22.2152 (63)
												-915.4729 (63)
Output from w/h												
	172.1453	130.5718	106.2052	55.3832	21.6603	6.1105	0.8764	31.4046	61.1491	111.2957	148.6082	171.4131 (64)
												1016.8234 (64)
Heat gains from water heating, kWh/month												
	83.9274	74.2782	77.6089	66.1638	60.6178	54.2595	52.3592	57.8557	62.6660	73.0452	77.1682	82.2436 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	112.8056	110.5330	104.3130	91.8941	81.4755	75.3604	70.3753	77.7630	87.0362	98.1790	107.1780	110.5425 (72)
Total internal gains												
	652.9129	648.2809	623.0488	580.0596	535.7038	501.3779	481.4676	491.2149	519.5001	561.2132	604.1494	635.7247 (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						9.2400	11.2829		0.4600	0.0000		0.7700	36.9269 (75)	
Southeast						4.1000	36.7938		0.4600	0.0000		0.7700	53.4327 (77)	
Southwest						2.9400	36.7938		0.4600	0.0000		0.7700	38.3152 (79)	
Southwest						9.9700	36.7938		0.4600	0.0000		0.7700	129.9328 (79)	

Solar gains	258.6076	452.7700	652.0794	862.5666	1015.9906	1030.5683	984.4537	866.6406	724.4449	509.1917	311.9860	219.8689	(83)	
Total gains	911.5206	1101.0509	1275.1282	1442.6262	1551.6944	1531.9462	1465.9213	1357.8555	1243.9450	1070.4049	916.1354	855.5935	(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	26.3757	26.4684	26.5599	26.9983	27.0820	27.4782	27.4782	27.5529	27.3242	27.0820	26.9133	26.7392
alpha	2.7584	2.7646	2.7707	2.7999	2.8055	2.8319	2.8319	2.8369	2.8216	2.8055	2.7942	2.7826
util living area	0.9539	0.9248	0.8759	0.7873	0.6617	0.5101	0.3866	0.4287	0.6276	0.8324	0.9296	0.9604 (86)
MIT	18.9500	19.2809	19.7363	20.2613	20.6517	20.8818	20.9601	20.9460	20.7790	20.2516	19.5132	18.8981 (87)
Th 2	19.7148	19.7187	19.7225	19.7404	19.7438	19.7595	19.7595	19.7624	19.7535	19.7438	19.7370	19.7299 (88)
util rest of house	0.9450	0.9109	0.8531	0.7492	0.6027	0.4274	0.2852	0.3240	0.5460	0.7927	0.9141	0.9526 (89)
MIT 2	17.0622	17.5343	18.1754	18.9002	19.3989	19.6709	19.7404	19.7343	19.5691	18.9132	17.8861	16.9969 (90)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.1598 (91)
MIT	17.3640	17.8135	18.4249	19.1178	19.5991	19.8645	19.9353	19.9280	19.7625	19.1272	18.1461	17.3008 (92)
Temperature adjustment												
adjusted MIT	17.2140	17.6635	18.2749	18.9678	19.4491	19.7145	19.7853	19.7780	19.6125	18.9772	17.9961	17.1508 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9199	0.8807	0.8207	0.7219	0.5874	0.4242	0.2874	0.3254	0.5357	0.7630	0.8847	0.9296	(94)
Useful gains	838.5327	969.6583	1046.4379	1041.4853	911.4959	649.9081	421.3082	441.8235	666.4132	816.7073	810.5082	795.3268	(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	1819.9251	1792.4214	1647.8841	1386.0991	1063.5783	691.8440	430.8882	455.7105	749.8918	1149.7773	1504.8838	1800.3013	(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	730.1559	552.8968	447.4760	248.1220	113.1493	0.0000	0.0000	0.0000	0.0000	247.8040	499.9504	747.7010	(98)
Space heating												3587.2555	(98)
Space heating per m2												(98) / (4) =	37.2586 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3968.2030 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	730.1559	552.8968	447.4760	248.1220	113.1493	0.0000	0.0000	0.0000	0.0000	247.8040	499.9504	747.7010	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	807.6946	611.6115	494.9956	274.4712	125.1651	0.0000	0.0000	0.0000	0.0000	274.1195	553.0425	827.1029	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	172.1453	130.5718	106.2052	55.3832	21.6603	6.1105	0.8764	31.4046	61.1491	111.2957	148.6082	171.4131	(64)
Efficiency of water heater (217)m	88.1424	88.1394	88.1305	88.2383	88.4912	79.7000	79.7000	79.7000	79.7000	86.7888	87.7021	79.7000	(216)
Fuel for water heating, kWh/month	195.3037	148.1424	120.5091	62.7655	24.4774	7.6668	1.0996	39.4035	76.7241	128.2374	169.4466	194.3639	(219)
Water heating fuel used												1168.1400	(219)
Annual totals kWh/year													
Space heating fuel - main system												3968.2030	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
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)												393.8748	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 908 * 1.00) =										-1074.8994		-1074.8994	(233)
Total delivered energy for all uses												4580.3183	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3968.2030	3.4800	138.0935	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1168.1400	3.4800	40.6513	(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	393.8748	13.1900	51.9521	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1074.8994	13.1900	-141.7792	(252)
Total energy cost			225.4051	(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] =	0.6701 (257)
SAP value		90.6523
SAP rating (Section 12)		91 (258)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP band

B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3968.2030	0.2160	857.1318 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1168.1400	0.2160	252.3182 (264)
Space and water heating			1109.4501 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1074.8994	0.5190	-557.8728 (269)
Total kg/year			820.8733 (272)
CO2 emissions per m2			8.5300 (273)
EI value			92.2143
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	48.1400 (1b)	x 2.3900 (2b)	= 115.0546 (1b) - (3b)
First floor	48.1400 (1c)	x 2.6100 (2c)	= 125.6454 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.2800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.7000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.2077 (8)
Pressure test					Yes
Measured/design AP50					4.7200
Infiltration rate					0.4437 (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) =		0.4437 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.4659	0.4326	0.4437	0.4215	0.4215	0.4104	0.3994	0.3883	0.3772	0.4104	0.3883	0.4104 (22b)
	0.6085	0.5936	0.5984	0.5888	0.5888	0.5842	0.5797	0.5754	0.5711	0.5842	0.5754	0.5842 (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
Solid Door			2.0300	0.6400	1.2992		(26)
Half Glaze			2.0300	1.3000	2.6390		(26a)
Window (Uw = 1.30)			16.2800	1.2357	20.1179		(27)
French Door (Uw = 1.30)			9.9700	1.2357	12.3203		(27)
GF B&B J150 P/A=0.60			48.1400	0.1300	6.2582	75.0000	3610.5000 (28a)
EW Brick AAC011	131.1700	18.3100	112.8600	0.2400	27.0864	42.1000	4751.4060 (29a)
EW Brick AAC018		12.0000	13.2800	0.2600	3.4528	60.0000	796.8000 (29a)
PR 400mm MW044	48.1400		48.1400	0.1100	5.2954	9.0000	433.2600 (30)
Total net area of external elements Aum(A, m ²)			252.7300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		78.4692		(33)
GF Masonry			24.1800			39.0000	943.0200 (32c)
GF Timber			73.8000			9.0000	664.2000 (32c)
1F Timber			98.0400			9.0000	882.3600 (32c)
Internal Floor			48.1400			18.0000	866.5200 (32d)
Internal Ceiling			48.1400			9.0000	433.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 13381.3260 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							138.9834 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0300 (36)
Total fabric heat loss							(33) + (36) = 88.4992 (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	48.3368	47.1491	47.5352	46.7728	46.7728	46.4063	46.0495	45.7025	45.3653	46.4063	45.7025	46.4063 (38)
Average = Sum(39)m / 12 =	136.8359	135.6483	136.0344	135.2720	135.2720	134.9054	134.5487	134.2017	133.8644	134.9054	134.2017	134.9054 (39)
												135.0496 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.4212	1.4089	1.4129	1.4050	1.4050	1.4012	1.3975	1.3939	1.3904	1.4012	1.3939	1.4012 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.7023 (42)
Average daily hot water use (litres/day)												98.3800 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	108.2180	104.2828	100.3476	96.4124	92.4772	88.5420	88.5420	92.4772	96.4124	100.3476	104.2828	108.2180 (44)
Energy content (annual)	160.4842	140.3605	144.8395	126.2746	121.1635	104.5549	96.8854	111.1775	112.5053	131.1140	143.1212	155.4204 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1547.9009 (45)
	24.0726	21.0541	21.7259	18.9412	18.1745	15.6832	14.5328	16.6766	16.8758	19.6671	21.4682	23.3131 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4751 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7965 (55)
Total storage loss												
	24.6926	22.3030	24.6926	23.8961	24.6926	23.8961	24.6926	24.6926	23.8961	24.6926	23.8961	24.6926 (56)
If cylinder contains dedicated solar storage												
	14.9455	13.4992	14.9455	14.4634	14.9455	14.4634	14.9455	14.9455	14.4634	14.9455	14.4634	14.9455 (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												
	198.6922	174.8709	181.6517	156.4964	146.5771	128.9236	122.0664	137.2890	144.0778	167.9262	180.0967	193.6283 (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												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3113 (H8)
Utilisation factor												0.5336 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												98.3800 (H14)
Volume ratio Veff/V												1.1130 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-952.2442 (H17)
Solar input	-31.0645	-44.1718	-75.9206	-102.4345	-120.3155	-128.5159	-125.8132	-112.6067	-88.1632	-60.9530	-36.7411	-25.5441 (63)
												-952.2442 (63)
Output from w/h												
	167.6277	130.6992	105.7311	54.0619	26.2616	0.4076	0.0000	24.6823	55.9146	106.9732	143.3555	168.0843 (64)
												983.7989 (64)
Heat gains from water heating, kWh/month												
	83.9274	74.2782	77.6089	66.1638	60.6178	54.2595	52.3592	57.8557	62.6660	73.0452	77.1682	82.2436 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390	162.1390 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	55.7570	49.5229	40.2747	30.4906	22.7921	19.2420	20.7917	27.0258	36.2740	46.0582	53.7567	57.3067 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	373.3878	377.2623	367.4985	346.7124	320.4737	295.8130	279.3381	275.4635	285.2274	306.0135	332.2522	356.9129 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162	53.9162 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927	-108.0927 (71)
Water heating gains (Table 5)												
	112.8056	110.5330	104.3130	91.8941	81.4755	75.3604	70.3753	77.7630	87.0362	98.1790	107.1780	110.5425 (72)
Total internal gains												
	652.9129	648.2809	623.0488	580.0596	535.7038	501.3779	481.4676	491.2149	519.5001	561.2132	604.1494	635.7247 (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				9.2400	14.6176		0.4600	0.0000		0.7700	47.8408 (75)	
Southeast				4.1000	45.1778		0.4600	0.0000		0.7700	65.6081 (77)	
Southwest				2.9400	45.1778		0.4600	0.0000		0.7700	47.0458 (79)	
Southwest				9.9700	45.1778		0.4600	0.0000		0.7700	159.5398 (79)	

Solar gains	320.0345	477.9111	697.3622	934.6518	1051.5316	1160.7343	1099.2813	987.9314	820.5284	580.8094	385.0301	267.3648 (83)
Total gains	972.9475	1126.1920	1320.4110	1514.7114	1587.2354	1662.1122	1580.7489	1479.1463	1340.0285	1142.0226	989.1796	903.0895 (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	27.1642	27.4020	27.3242	27.4782	27.4782	27.5529	27.6260	27.6974	27.7672	27.5529	27.6974	27.5529
alpha	2.8109	2.8268	2.8216	2.8319	2.8319	2.8369	2.8417	2.8465	2.8511	2.8369	2.8465	2.8369
util living area	0.9413	0.9147	0.8552	0.7488	0.6115	0.4332	0.3222	0.3417	0.5545	0.7839	0.9044	0.9491 (86)
MIT	19.2020	19.4593	19.9147	20.4089	20.7485	20.9313	20.9782	20.9748	20.8587	20.4386	19.7854	19.1727 (87)
Th 2	19.7471	19.7565	19.7535	19.7595	19.7595	19.7624	19.7653	19.7680	19.7707	19.7624	19.7680	19.7624 (88)
util rest of house												
	0.9300	0.8992	0.8293	0.7059	0.5467	0.3490	0.2243	0.2388	0.4678	0.7348	0.8837	0.9391 (89)
MIT 2	17.4419	17.8101	18.4414	19.1050	19.5247	19.7172	19.7568	19.7581	19.6636	19.1682	18.2875	17.4109 (90)

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Living area fraction									fLA = Living area / (4) =			0.1598 (91)	
MIT	17.7232	18.0737	18.6769	19.3134	19.7203	19.9113	19.9521	19.9526	19.8546	19.3713	18.5269	17.6925 (92)	
Temperature adjustment													-0.1500
adjusted MIT	17.5732	17.9237	18.5269	19.1634	19.5703	19.7613	19.8021	19.8026	19.7046	19.2213	18.3769	17.5425 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9028	0.8689	0.7981	0.6824	0.5360	0.3489	0.2273	0.2418	0.4627	0.7095	0.8530	0.9137	(94)
Useful gains	878.3614	978.5697	1053.7903	1033.6879	850.6841	579.8940	359.2449	357.6648	620.0722	810.2091	843.8083	825.1564	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	1734.1556	1712.3831	1568.0599	1307.1867	956.4177	601.8527	363.5577	362.6955	669.9384	1055.1312	1406.0174	1692.0497	(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	636.7109	493.1227	382.6166	196.9191	78.6658	0.0000	0.0000	0.0000	0.0000	182.2220	404.7906	644.9686	(98)
Space heating												3020.0162	(98)
Space heating per m2										(98) / (4) =		31.3670	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3340.7259 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	636.7109	493.1227	382.6166	196.9191	78.6658	0.0000	0.0000	0.0000	0.0000	182.2220	404.7906	644.9686	(98)
Space heating efficiency (main heating system 1)	90.4000	90.4000	90.4000	90.4000	90.4000	0.0000	0.0000	0.0000	0.0000	90.4000	90.4000	90.4000	(210)
Space heating fuel (main heating system)	704.3262	545.4897	423.2484	217.8309	87.0197	0.0000	0.0000	0.0000	0.0000	201.5730	447.7772	713.4609	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	167.6277	130.6992	105.7311	54.0619	26.2616	0.4076	0.0000	24.6823	55.9146	106.9732	143.3555	168.0843	(64)
Efficiency of water heater (217)m	87.9395	87.9268	87.8466	87.8592	87.4612	79.7000	79.7000	79.7000	79.7000	86.1231	87.3336	87.9587	(216)
Fuel for water heating, kWh/month	190.6169	148.6454	120.3588	61.5324	30.0266	0.5114	0.0000	30.9690	70.1563	124.2097	164.1470	191.0944	(219)
Water heating fuel used												1132.2679	(219)
Annual totals kWh/year													
Space heating fuel - main system												3340.7259	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
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)												393.8748	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.48 * 1031 * 1.00) =									-1220.7247			-1220.7247	(233)
Total delivered energy for all uses												3771.1440	(238)

10a. Fuel costs - using BEDF prices (516)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3340.7259	9.7400	325.3867	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1132.2679	9.7400	110.2829	(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	393.8748	36.8500	145.1428	(250)
Additional standing charges			104.0000	(251)
Energy saving/generation technologies				
PV Unit	-1220.7247	36.8500	-449.8370	(252)
Total energy cost			281.0379	(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	3340.7259	0.2160	721.5968	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)

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Water heating (other fuel)	1132.2679	0.2160	244.5699 (264)
Space and water heating			966.1667 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	393.8748	0.5190	204.4210 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	0.5190	-633.5561 (269)
Total kg/year			601.9066 (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	3340.7259	1.2200	4075.6856 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1132.2679	1.2200	1381.3669 (264)
Space and water heating			5457.0525 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	393.8748	3.0700	1209.1955 (268)
Energy saving/generation technologies			
PV Unit	-1220.7247	3.0700	-3747.6247 (269)
Primary energy kWh/year			3302.3733 (272)
Primary energy kWh/m2/year			34.2997 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	139.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	317.72 (P1)
Transmission heat loss coefficient	88.50 (37)
Summer heat loss coefficient	406.22 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
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)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	9.2400	98.8453	0.4600	0.0000	0.9000	378.1187
South East	4.1000	119.9223	0.4600	0.0000	0.9000	203.5562
South West	2.9400	119.9223	0.4600	0.0000	0.9000	145.9647
South West	9.9700	119.9223	0.4600	0.0000	0.9000	494.9891

total: 1222.6287

	Jun	Jul	Aug	
Solar gains	1295	1223	1097	(P4)
Internal gains	519	499	508	
Total summer gains	1814	1722	1605	(P5)
Summer gain/loss ratio	4.46	4.24	3.95	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 139.0)	1.03	1.03	1.03	
Threshold temperature	21.49	23.17	22.78	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			