

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-240			Issued on Date	08/01/2024
Assessment Reference	As Built	Prop Type Ref	RPv3 Det Op		
Property	69, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	88 B	DER	12.81	TER	16.79
Environmental	88 B	% DER<TER	23.70		
CO ₂ Emissions (t/year)	1.37	DFEE	51.05	TFEE	59.33
General Requirements Compliance	Pass	% DFEE<TFEE	13.96		
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk			Assessor ID	T510-0001
Client	Drew Smith				

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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 137 m²

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

1a TER and DER

Fuel for main heating:Mains gas

Fuel factor:1.00 (mains gas)

Target Carbon Dioxide Emission Rate (TER) 16.79 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.81 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)59.3 kWh/m²/yr

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

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.32 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.17 (max. 0.20)	0.28 (max. 0.35)	OK
Openings	1.41 (max. 2.00)	1.80 (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: 4.81 (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 SYSTEM s18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.42 kWh/day
Permitted by DBSCG 2.30 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North: 8.24 m², No overhang
Windows facing East: 4.25 m², No overhang
Windows facing South: 8.65 m², No overhang
Windows facing West: 0.60 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

External wall U-value 0.14 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.99 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	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a) + (3b) + (3c) + (3d) + (3e) ... (3n) =	347.4308 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
											Air changes per hour	
Infiltration due to chimneys, flues and fans					= (6a)+(6b)+(7a)+(7b)+(7c) =					0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes	
Measured/design AP50											4.8100	
Infiltration rate											0.2405 (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) =	0.2405 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	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)
Adj infilt rate	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)
	0.3066	0.3006	0.2946	0.2646	0.2585	0.2285	0.2285	0.2225	0.2405	0.2585	0.2706	0.2826 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:											0.5000 (23a)	
Effective ac	0.5566	0.5506	0.5446	0.5146	0.5085	0.5000	0.5000	0.5000	0.5000	0.5085	0.5206	0.5326 (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						
Solid Door			2.1200	1.3000	2.7560			(26)					
Window (Uw = 1.40)			17.2200	1.3258	22.8295			(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924			(27)					
Roof Window (Uw = 1.80)			1.4600	1.6791	2.4515			(27a)					
150mm EPS B&B			53.1200	0.1800	9.5616	75.0000	3984.0000	(28a)					
140mm Timber Frame	172.8600	21.4100	151.4500	0.1900	28.7755	9.0000	1363.0500	(29a)					
W2V	30.7800		30.7800	0.1400	4.3092	18.0000	554.0400	(29a)					
Dormer Cheek	10.5100	2.4500	8.0600	0.3200	2.5792	18.0000	145.0800	(29a)					
400mm Mineral Wool	14.3700		14.3700	0.1100	1.5807	9.0000	129.3300	(30)					
Sloping	43.0100	1.4600	41.5500	0.2000	8.3100	9.0000	373.9500	(30)					
Dormer Roof	4.3500		4.3500	0.2800	1.2180	9.0000	39.1500	(30)					
C2V	22.3000		22.3000	0.1400	3.1220	9.0000	200.7000	(30)					
Total net area of external elements Aum(A, m2)			351.3000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.4857			(33)					
Timber GF			74.7800			9.0000	673.0200	(32c)					
Timber FF			135.1700			9.0000	1216.5300	(32c)					
Timber 2F			38.0200			9.0000	342.1800	(32c)					
Internal Floor			53.1200			18.0000	956.1600	(32d)					
Internal Floor 2			30.8200			18.0000	554.7600	(32d)					
Internal Ceiling			53.1200			18.0000	956.1600	(32e)					
Internal Ceiling 2			30.8200			18.0000	554.7600	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12042.8700	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.8657	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.5664	(36)					
Total fabric heat loss						(33) + (36) =	112.0520	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 63.8197	Feb 63.1303	Mar 62.4410	Apr 58.9943	May 58.3049	Jun 57.3261	Jul 57.3261	Aug 57.3261	Sep 57.3261	Oct 58.3049	Nov 59.6836	Dec 61.0623	(38)
Heat transfer coeff	175.8717	175.1824	174.4930	171.0463	170.3569	169.3781	169.3781	169.3781	169.3781	170.3569	171.7356	173.1143	(39)
Average = Sum(39)m / 12 =												171.6391	(39)
HLP	Jan 1.2832	Feb 1.2781	Mar 1.2731	Apr 1.2480	May 1.2429	Jun 1.2358	Jul 1.2358	Aug 1.2358	Sep 1.2358	Oct 1.2429	Nov 1.2530	Dec 1.2631	(40)
HLP (average)												1.2523	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy content	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)
Energy content (annual)												Total = Sum(45)m = 1625.9817 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2869	22.1161	22.8218	19.8966	19.0913	16.4743	15.2659	17.5178	17.7271	20.6592	22.5511	24.4890 (46)
Water storage loss:												210.0000 (47)
Store volume												1.4200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7668 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (56)
If cylinder contains dedicated solar storage	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935 (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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935 (64)
Total per year (kWh/year) = Sum(64)m =												2179.7597 (64)
Heat gains from water heating, kWh/month	93.6792	83.0093	88.2150	80.5170	79.9456	72.9309	71.4660	76.4578	75.7078	83.4211	86.4011	91.9106 (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	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0970	24.9555	20.2952	15.3647	11.4853	9.6964	10.4773	13.6188	18.2791	23.2095	27.0890	28.8779 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.0438	309.2195	301.2167	284.1795	262.6732	242.4603	228.9569	225.7811	233.7839	250.8211	272.3274	292.5403 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563 (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)	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507 (71)
Water heating gains (Table 5)	125.9130	123.5258	118.5685	111.8292	107.4538	101.2929	96.0564	102.7658	105.1497	112.1251	120.0015	123.5357 (72)
Total internal gains	529.7227	527.3698	509.7494	481.0425	451.2813	423.1187	405.1596	411.8347	426.8818	455.8247	489.0869	514.6229 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				8.2400	10.6334		0.7200		0.7000		0.7700		30.6029 (74)
East				4.2500	19.6403		0.7200		0.7000		0.7700		29.1541 (76)
South				4.1300	46.7521		0.7200		0.7000		0.7700		67.4395 (78)
West				0.6000	19.6403		0.7200		0.7000		0.7700		4.1159 (80)
South				4.5200	46.7521		0.7200		0.7000		0.7700		73.8079 (78)
West				1.4600	26.0000		0.6300		0.7000		1.0000		15.0663 (82)
Solar gains	220.1867	386.1855	556.8599	735.9081	864.9153	876.1918	837.4721	738.7741	618.5993	434.5970	265.7855		187.0915 (83)
Total gains	749.9094	913.5553	1066.6093	1216.9505	1316.1967	1299.3105	1242.6317	1150.6088	1045.4811	890.4218	754.8723		701.7144 (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	19.0209	19.0958	19.1712	19.5575	19.6367	19.7501	19.7501	19.7501	19.7501	19.6367	19.4790	19.3239
alpha	2.2681	2.2731	2.2781	2.3038	2.3091	2.3167	2.3167	2.3167	2.3167	2.3091	2.2986	2.2883
util living area	0.9659	0.9465	0.9141	0.8534	0.7595	0.6331	0.5098	0.5550	0.7364	0.8868	0.9504	0.9704 (86)
MIT	18.0362	18.3757	18.9094	19.6014	20.2054	20.6439	20.8477	20.8086	20.4566	19.6654	18.7392	17.9950 (87)
Th 2	19.8540	19.8580	19.8620	19.8818	19.8858	19.8915	19.8915	19.8915	19.8915	19.8858	19.8778	19.8699 (88)
util rest of house	0.9609	0.9387	0.9010	0.8299	0.7177	0.5620	0.4071	0.4539	0.6759	0.8637	0.9418	0.9660 (89)
MIT 2	15.9027	16.3946	17.1643	18.1566	18.9905	19.5601	19.7885	19.7536	19.3442	18.2680	16.9363	15.8499 (90)
Living area fraction												fLA = Living area / (4) = 0.1213 (91)
MIT	16.1614	16.6348	17.3760	18.3318	19.1378	19.6915	19.9169	19.8815	19.4791	18.4375	17.1549	16.1100 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.0114	16.4848	17.2260	18.1818	18.9878	19.5415	19.7669	19.7315	19.3291	18.2875	17.0049	15.9600 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9332	0.9033	0.8581	0.7835	0.6772	0.5364	0.3943	0.4375	0.6388	0.8178	0.9077	0.9409 (94)
Useful gains	699.8505	825.2220	915.2194	953.5352	891.3019	696.8855	490.0090	503.3610	667.8337	728.2301	685.2192	660.2771 (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	2059.7001	2029.4562	1871.6046	1587.6223	1241.5243	836.9828	536.4063	564.2862	885.6940	1309.6171	1701.0267	2035.8258 (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	1011.7280	809.2454	711.5506	456.5427	260.5655	0.0000	0.0000	0.0000	0.0000	432.5519	731.3814	1023.4082 (98)
Space heating												5436.9738 (98)
Space heating per m2												39.6686 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.6000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	6001.0749	(211)

[illegible][illegible]

Electricity for pumps and fans:

(MEVDecentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)

mechanical ventilation fans (SFP = 0.2308)

central heating pump

main heating flue fan

Total electricity for the above, kWh/year

Electricity for lighting (calculated in Appendix L)

Energy saving/generation technologies (Appendices M ,N and Q)

PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =

Total delivered energy for all uses

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6001.0749	0.2160	1296.2322 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2553.9634	0.2160	551.6561 (264)
Space and water heating			1847.8883 (265)
Pumps and fans	172.8330	0.5190	89.7003 (267)
Energy for lighting	496.2015	0.5190	257.5286 (268)
Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total CO2, kg/year			1756.0889 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8100 (273)

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

Total Floor Area	TFA	12.8100	ZC1
Assumed number of occupants	N	137.0600	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	2.9113	
CO2 emissions from appliances, equation (L14)		0.5190	
CO2 emissions from cooking, equation (L16)		13.2318	ZC2
Total CO2 emissions		1.3780	ZC3
Residual CO2 emissions offset from biofuel CHP		27.4198	ZC4
Additional allowable electricity generation, kWh/m ² /year		0.0000	ZC5
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC6
Net CO2 emissions		0.0000	ZC7
		27.4198	ZC7

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 347.4308 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1151 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3651 (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) =		0.3651 (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	0.4655	0.4564	0.4473	0.4016	0.3925	0.3469	0.3469	0.3377	0.3651	0.3925	0.4108	0.4290 (22b)
Effective ac	0.6084	0.6042	0.6000	0.5807	0.5770	0.5602	0.5602	0.5570	0.5667	0.5770	0.5844	0.5920 (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			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			21.7400	1.3258	28.8220		(27)
TER Room Window (Uw = 1.70)			1.4600	1.5918	2.3240		(27a)
150mm EPS B&B			53.1200	0.1300	6.9056		(28a)
140mm Timber Frame	172.8600	21.4100	151.4500	0.1800	27.2610		(29a)
W2V	30.7800		30.7800	0.1800	5.5404		(29a)
Dormer Cheek	10.5100	2.4500	8.0600	0.1800	1.4508		(29a)
400mm Mineral Wool	14.3700		14.3700	0.1300	1.8681		(30)
Sloping	43.0100	1.4600	41.5500	0.1300	5.4015		(30)
Dormer Roof	4.3500		4.3500	0.1300	0.5655		(30)
C2V	22.3000		22.3000	0.1300	2.8990		(30)
Total net area of external elements Aum(A, m ²)			351.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.1578		(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)							14.8024 (36)
Total fabric heat loss						(33) + (36) =	99.9602 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	69.7503	69.2679	68.7950	66.5738	66.1582	64.2237	64.2237	63.8654	64.9688	66.1582	66.9989	67.8778 (38)
Heat transfer coeff	169.7106	169.2281	168.7552	166.5340	166.1185	164.1839	164.1839	163.8256	164.9291	166.1185	166.9592	167.8381 (39)
Average = Sum(39)m / 12 =												166.5321 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2382	1.2347	1.2313	1.2150	1.2120	1.1979	1.1979	1.1953	1.2033	1.2120	1.2181	1.2246 (40)
HLP (average)												1.2150 (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												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy conte	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)

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Energy content (annual)												Total = Sum(45)m = 1625.9817 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.2869	22.1161	22.8218	19.8966	19.0913	16.4743	15.2659	17.5178	17.7271	20.6592	22.5511	24.4890 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7016 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.9188 (55)
Total storage loss												
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (56)
If cylinder contains dedicated solar storage												
	28.4842	25.7277	28.4842	27.5653	28.4842	27.5653	28.4842	28.4842	27.5653	28.4842	27.5653	28.4842 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	220.3261	194.1796	203.8922	182.7216	179.0219	159.9063	153.5192	168.5322	168.2577	189.4744	200.4180	215.0069 (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												
	220.3261	194.1796	203.8922	182.7216	179.0219	159.9063	153.5192	168.5322	168.2577	189.4744	200.4180	215.0069 (64)
Heat gains from water heating, kWh/month												
	97.4500	86.4151	91.9857	84.1661	83.7163	76.5800	75.2367	80.2285	79.3568	87.1918	90.0502	95.6813 (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	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	28.0970	24.9555	20.2952	15.3647	11.4853	9.6964	10.4773	13.6188	18.2791	23.2095	27.0890	28.8779 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	306.0438	309.2195	301.2167	284.1795	262.6732	242.4603	228.9569	225.7811	233.7839	250.8211	272.3274	292.5403 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563 (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)												
	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507 (71)
Water heating gains (Table 5)												
	130.9811	128.5939	123.6367	116.8973	112.5219	106.3611	101.1246	107.8340	110.2178	117.1932	125.0697	128.6039 (72)
Total internal gains	534.7909	532.4380	514.8175	486.1107	456.3495	428.1868	410.2277	416.9029	431.9499	460.8929	494.1550	519.6911 (73)

6. Solar gains

[Jan]				Area	Solar flux		g		FF		Access		Gains
				m2	Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North				8.2400	10.6334		0.6300		0.7000		0.7700		26.7776 (74)
East				4.2500	19.6403		0.6300		0.7000		0.7700		25.5099 (76)
South				8.6500	46.7521		0.6300		0.7000		0.7700		123.5915 (78)
West				0.6000	19.6403		0.6300		0.7000		0.7700		3.6014 (80)
West				1.4600	26.0000		0.6300		0.7000		1.0000		15.0663 (82)
Solar gains	194.5467	341.8237	494.2061	654.7847	770.7083	781.1547	746.4782	657.7995	549.6043	385.0531	234.9526	165.2262	(83)
Total gains	729.3375	874.2617	1009.0237	1140.8953	1227.0578	1209.3415	1156.7059	1074.7024	981.5543	845.9459	729.1076	684.9173	(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	56.0841	56.2439	56.4015	57.1538	57.2968	57.9719	57.9719	58.0987	57.7100	57.2968	57.0083	56.7097
alpha	4.7389	4.7496	4.7601	4.8103	4.8198	4.8648	4.8648	4.8732	4.8473	4.8198	4.8006	4.7806
util living area	0.9988	0.9969	0.9913	0.9708	0.9082	0.7665	0.5992	0.6588	0.8840	0.9834	0.9974	0.9991 (86)
MIT	19.5800	19.7496	20.0231	20.3855	20.7083	20.9159	20.9801	20.9690	20.8166	20.3931	19.9215	19.5564 (87)
Th 2	19.8895	19.8923	19.8951	19.9080	19.9104	19.9217	19.9217	19.9238	19.9173	19.9104	19.9055	19.9004 (88)
util rest of house	0.9984	0.9958	0.9880	0.9588	0.8688	0.6740	0.4650	0.5248	0.8194	0.9745	0.9962	0.9988 (89)
MIT 2	17.9955	18.2452	18.6454	19.1747	19.6149	19.8634	19.9142	19.9106	19.7631	19.1937	18.5062	17.9686 (90)
Living area fraction	18.1877	18.4277	18.8125	19.3215	19.7475	19.9910	20.0434	20.0389	19.8909	19.3391	18.6778	18.1611 (91)
MIT	18.1877	18.4277	18.8125	19.3215	19.7475	19.9910	20.0434	20.0389	19.8909	19.3391	18.6778	18.1611 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1877	18.4277	18.8125	19.3215	19.7475	19.9910	20.0434	20.0389	19.8909	19.3391	18.6778	18.1611 (93)

8. Space heating requirement

Utilisation	0.9973	0.9936	0.9832	0.9501	0.8616	0.6807	0.4810	0.5403	0.8175	0.9677	0.9942	0.9980 (94)
Useful gains	727.3940	868.6534	992.0897	1083.9564	1057.2636	823.2055	556.3414	580.6367	802.3755	818.6254	724.8819	683.5616 (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	2356.8808	2289.2599	2077.7967	1735.5371	1336.8334	885.1185	565.3582	596.1469	955.0809	1451.7253	1933.0154	2343.2098 (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	1212.3382	954.6476	807.7660	469.1381	207.9999	0.0000	0.0000	0.0000	0.0000	471.0263	869.8561	1234.7782 (98)

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Space heating 6227.5504 (98)
 Space heating per m2 (98) / (4) = 45.4367 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6660.4817 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1212.3382	954.6476	807.7660	469.1381	207.9999	0.0000	0.0000	0.0000	0.0000	471.0263	869.8561	1234.7782	(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)	1296.6184	1021.0135	863.9209	501.7519	222.4598	0.0000	0.0000	0.0000	0.0000	503.7714	930.3274	1320.6184	(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	220.3261	194.1796	203.8922	182.7216	179.0219	159.9063	153.5192	168.5322	168.2577	189.4744	200.4180	215.0069	(64)
Efficiency of water heater (217)m	88.6715	88.4944	88.1187	87.2218	85.2147	79.8000	79.8000	79.8000	79.8000	87.1479	88.2833	88.7355	(216)
Fuel for water heating, kWh/month	248.4744	219.4259	231.3836	209.4908	210.0832	200.3838	192.3800	211.1932	210.8493	217.4170	227.0169	242.3009	(217)
Water heating fuel used												2620.3990	(219)
Annual totals kWh/year													
Space heating fuel - main system												6660.4817	(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)												496.2015	(232)
Total delivered energy for all uses												9852.0822	(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	6660.4817	0.2160	1438.6640 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2620.3990	0.2160	566.0062 (264)
Space and water heating			2004.6702 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.2015	0.5190	257.5286 (268)
Total CO2, kg/m2/year			2301.1238 (272)
Emissions per m2 for space and water heating			14.6262 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.8789 (272b)
Emissions per m2 for pumps and fans			0.2840 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6262 * 1.00) + 1.8789 + 0.2840, rounded to 2 d.p.			16.7900 (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	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 347.4308 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour 40.0000 / (5) = 0.1151 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.3556 (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) =				0.3556 (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	0.4534	0.4445	0.4356	0.3912	0.3823	0.3378	0.3378	0.3290	0.3556	0.3823	0.4001	0.4179 (22b)
Effective ac	0.6028	0.5988	0.5949	0.5765	0.5731	0.5571	0.5571	0.5541	0.5632	0.5731	0.5800	0.5873 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			17.2200	1.3258	22.8295		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.4600	1.6791	2.4515		(27a)
150mm EPS B&B			53.1200	0.1800	9.5616	75.0000	3984.0000 (28a)
140mm Timber Frame	172.8600	21.4100	151.4500	0.1900	28.7755	9.0000	1363.0500 (29a)
W2V	30.7800		30.7800	0.1400	4.3092	18.0000	554.0400 (29a)
Dormer Cheek	10.5100	2.4500	8.0600	0.3200	2.5792	18.0000	145.0800 (29a)
400mm Mineral Wool	14.3700		14.3700	0.1100	1.5807	9.0000	129.3300 (30)
Sloping	43.0100	1.4600	41.5500	0.2000	8.3100	9.0000	373.9500 (30)
Dormer Roof	4.3500		4.3500	0.2800	1.2180	9.0000	39.1500 (30)
C2V	22.3000		22.3000	0.1400	3.1220	9.0000	200.7000 (30)
Total net area of external elements Aum(A, m ²)			351.3000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.4857		(33)
Timber GF			74.7800			9.0000	673.0200 (32c)
Timber FF			135.1700			9.0000	1216.5300 (32c)
Timber 2F			38.0200			9.0000	342.1800 (32c)
Internal Floor			53.1200			18.0000	956.1600 (32d)
Internal Floor 2			30.8200			18.0000	554.7600 (32d)
Internal Ceiling			53.1200			9.0000	478.0800 (32e)
Internal Ceiling 2			30.8200			9.0000	277.3800 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss (33) + (36) = 11287.4100 (34)
82.3538 (35)
18.5664 (36)
112.0520 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	69.1122	68.6545	68.2059	66.0988	65.7046	63.8694	63.8694	63.5296	64.5763	65.7046	66.5021	67.3359 (38)
Heat transfer coeff	181.1642	180.7066	180.2580	178.1509	177.7566	175.9214	175.9214	175.5816	176.6283	177.7566	178.5542	179.3879 (39)
Average = Sum(39)m / 12 =												178.1490 (39)
HLP	1.3218	1.3184	1.3152	1.2998	1.2969	1.2835	1.2835	1.2811	1.2887	1.2969	1.3027	1.3088 (40)
HLP (average)												1.2998 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy content (annual)	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.8231	31.3312	32.3309	28.1869	27.0460	23.3386	21.6267	24.8169	25.1133	29.2672	31.9474	34.6928 (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	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0970	24.9555	20.2952	15.3647	11.4853	9.6964	10.4773	13.6188	18.2791	23.2095	27.0890	28.8779 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.0438	309.2195	301.2167	284.1795	262.6732	242.4603	228.9569	225.7811	233.7839	250.8211	272.3274	292.5403 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563 (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)	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507 (71)
Water heating gains (Table 5)	48.1494	46.6237	43.4556	39.1485	36.3522	32.4148	29.0681	33.3561	34.8796	39.3376	44.3714	46.6301 (72)
Total internal gains	448.9591	447.4678	431.6364	405.3618	377.1797	351.2405	335.1713	339.4250	353.6117	380.0372	410.4567	434.7173 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				8.2400	10.6334	0.7200	0.7000	0.7700	30.6029 (74)			
East				4.2500	19.6403	0.7200	0.7000	0.7700	29.1541 (76)			
South				4.1300	46.7521	0.7200	0.7000	0.7700	67.4395 (78)			
West				0.6000	19.6403	0.7200	0.7000	0.7700	4.1159 (80)			
South				4.5200	46.7521	0.7200	0.7000	0.7700	73.8079 (78)			
West				1.4600	26.0000	0.6300	0.7000	1.0000	15.0663 (82)			
Solar gains	220.1867	386.1855	556.8599	735.9081	864.9153	876.1918	837.4721	738.7741	618.5993	434.5970	265.7855	187.0915 (83)
Total gains	669.1459	833.6533	988.4963	1141.2698	1242.0951	1227.4323	1172.6434	1078.1991	972.2110	814.6343	676.2422	621.8088 (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	17.3069	17.3507	17.3939	17.5996	17.6387	17.8227	17.8227	17.8572	17.7514	17.6387	17.5599	17.4783
alpha	2.1538	2.1567	2.1596	2.1733	2.1759	2.1882	2.1882	2.1905	2.1834	2.1759	2.1707	2.1652
util living area	0.9695	0.9509	0.9201	0.8638	0.7763	0.6562	0.5369	0.5833	0.7593	0.8984	0.9560	0.9738 (86)
MIT	17.7505	18.1025	18.6644	19.3876	20.0495	20.5558	20.7997	20.7520	20.3349	19.4592	18.4731	17.6918 (87)
Th 2	19.8238	19.8264	19.8290	19.8410	19.8432	19.8538	19.8538	19.8557	19.8497	19.8432	19.8387	19.8339 (88)
util rest of house	0.9650	0.9437	0.9080	0.8415	0.7358	0.5850	0.4302	0.4796	0.7007	0.8772	0.9484	0.9699 (89)
MIT 2	16.8615	17.2110	17.7661	18.4782	19.1070	19.5679	19.7596	19.7313	19.3870	18.5623	17.5901	16.8098 (90)
Living area fraction	16.9693	17.3191	17.8751	18.5885	19.2213	19.6877	19.8857	19.8551	19.5020	18.6710	17.6972	0.1213 (91)
MIT	16.9693	17.3191	17.8751	18.5885	19.2213	19.6877	19.8857	19.8551	19.5020	18.6710	17.6972	16.9167 (92)
Temperature adjustment	16.9693	17.3191	17.8751	18.5885	19.2213	19.6877	19.8857	19.8551	19.5020	18.6710	17.6972	0.0000
adjusted MIT	16.9693	17.3191	17.8751	18.5885	19.2213	19.6877	19.8857	19.8551	19.5020	18.6710	17.6972	16.9167 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9491	0.9223	0.8810	0.8114	0.7100	0.5733	0.4335	0.4796	0.6794	0.8488	0.9284	0.9557 (94)
Ext temp.	635.1131	768.9022	870.8607	925.9923	881.8306	703.6779	508.3877	517.0714	660.5348	691.4658	627.8215	594.2470 (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	2295.2250	2244.2146	2050.4443	1726.0100	1336.9596	895.0354	578.0310	606.6504	954.1399	1434.6789	1892.1743	2281.2275 (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	1235.1233	991.4100	877.6102	576.0128	338.6160	0.0000	0.0000	0.0000	0.0000	552.9505	910.3340	1255.1135 (98)
Space heating												6737.1702 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space heating per m2

(98) / (4) = 49.1549 (99)

8c. Space cooling requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													
	0.0000	0.0000	0.0000	0.0000	0.0000	1653.6613	1301.8185	1334.4199	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6608	0.7271	0.6946	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1092.7833	946.6022	926.8783	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1536.6947	1470.9653	1366.1364	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	319.6163	390.1262	326.8080	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction													1036.5504 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	79.9041	97.5315	81.7020	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													259.1376 (107)
Space cooling per m2													1.8907 (108)
Energy for space heating													49.1549 (99)
Energy for space cooling													1.8907 (108)
Total													51.0456 (109)
Dwelling Fabric Energy Efficiency (DFEE)													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	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 347.4308 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.1151 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3651 (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) =		0.3651 (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	0.4655	0.4564	0.4473	0.4016	0.3925	0.3469	0.3469	0.3377	0.3651	0.3925	0.4108	0.4290 (22b)
Effective ac	0.6084	0.6042	0.6000	0.5807	0.5770	0.5602	0.5602	0.5570	0.5667	0.5770	0.5844	0.5920 (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			2.1200	1.0000	2.1200		(26)
TER Opening Type (Uw = 1.40)			21.7400	1.3258	28.8220		(27)
TER Room Window (Uw = 1.70)			1.4600	1.5918	2.3240		(27a)
150mm EPS B&B			53.1200	0.1300	6.9056		(28a)
140mm Timber Frame	172.8600	21.4100	151.4500	0.1800	27.2610		(29a)
W2V	30.7800		30.7800	0.1800	5.5404		(29a)
Dormer Cheek	10.5100	2.4500	8.0600	0.1800	1.4508		(29a)
400mm Mineral Wool	14.3700		14.3700	0.1300	1.8681		(30)
Sloping	43.0100	1.4600	41.5500	0.1300	5.4015		(30)
Dormer Roof	4.3500		4.3500	0.1300	0.5655		(30)
C2V	22.3000		22.3000	0.1300	2.8990		(30)
Total net area of external elements Aum(A, m ²)			351.3000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		85.1578		(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)							14.8024 (36)
Total fabric heat loss						(33) + (36) =	99.9602 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	69.7503	69.2679	68.7950	66.5738	66.1582	64.2237	64.2237	63.8654	64.9688	66.1582	66.9989	67.8778 (38)
Heat transfer coeff	169.7106	169.2281	168.7552	166.5340	166.1185	164.1839	164.1839	163.8256	164.9291	166.1185	166.9592	167.8381 (39)
Average = Sum(39)m / 12 =												166.5321 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2382	1.2347	1.2313	1.2150	1.2120	1.1979	1.1979	1.1953	1.2033	1.2120	1.2181	1.2246 (40)
HLP (average)												1.2150 (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												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy conte	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1625.9817 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.8231	31.3312	32.3309	28.1869	27.0460	23.3386	21.6267	24.8169	25.1133	29.2672	31.9474	34.6928 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	145.5634	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.0970	24.9555	20.2952	15.3647	11.4853	9.6964	10.4773	13.6188	18.2791	23.2095	27.0890	28.8779	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	306.0438	309.2195	301.2167	284.1795	262.6732	242.4603	228.9569	225.7811	233.7839	250.8211	272.3274	292.5403	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	37.5563	(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)	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	(71)
Water heating gains (Table 5)	48.1494	46.6237	43.4556	39.1485	36.3522	32.4148	29.0681	33.3561	34.8796	39.3376	44.3714	46.6301	(72)
Total internal gains	448.9591	447.4678	431.6364	405.3618	377.1797	351.2405	335.1713	339.4250	353.6117	380.0372	410.4567	434.7173	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				8.2400	10.6334	0.6300	0.7000		0.7700		26.7776 (74)	
East				4.2500	19.6403	0.6300	0.7000		0.7700		25.5099 (76)	
South				8.6500	46.7521	0.6300	0.7000		0.7700		123.5915 (78)	
West				0.6000	19.6403	0.6300	0.7000		0.7700		3.6014 (80)	
West				1.4600	26.0000	0.6300	0.7000		1.0000		15.0663 (82)	
Solar gains	194.5467	341.8237	494.2061	654.7847	770.7083	781.1547	746.4782	657.7995	549.6043	385.0531	234.9526	165.2262 (83)
Total gains	643.5058	789.2915	925.8425	1060.1465	1147.8880	1132.3952	1081.6495	997.2245	903.2160	765.0903	645.4094	599.9435 (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	56.0841	56.2439	56.4015	57.1538	57.2968	57.9719	57.9719	58.0987	57.7100	57.2968	57.0083	56.7097	
alpha	4.7389	4.7496	4.7601	4.8103	4.8198	4.8648	4.8648	4.8732	4.8473	4.8198	4.8006	4.7806	
util living area	0.9993	0.9980	0.9939	0.9779	0.9254	0.7970	0.6335	0.6973	0.9092	0.9889	0.9984	0.9995	(86)
MIT	19.5224	19.6930	19.9691	20.3375	20.6729	20.8993	20.9748	20.9604	20.7850	20.3421	19.8654	19.4992	(87)
Th 2	19.8895	19.8923	19.8951	19.9080	19.9104	19.9217	19.9217	19.9238	19.9173	19.9104	19.9055	19.9004	(88)
util rest of house	0.9991	0.9973	0.9915	0.9684	0.8911	0.7077	0.4951	0.5612	0.8530	0.9827	0.9978	0.9993	(89)
MIT 2	18.5389	18.7115	18.9886	19.3618	19.6793	19.8725	19.9150	19.9118	19.7891	19.3719	18.8943	18.5243	(90)
Living area fraction	fLA = Living area / (4) =												0.1213 (91)
MIT	18.6581	18.8305	19.1075	19.4801	19.7998	19.9971	20.0435	20.0389	19.9098	19.4895	19.0121	18.6425	(92)
Temperature adjustment													0.0000
adjusted MIT	18.6581	18.8305	19.1075	19.4801	19.7998	19.9971	20.0435	20.0389	19.9098	19.4895	19.0121	18.6425	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9987	0.9963	0.9891	0.9635	0.8868	0.7148	0.5118	0.5772	0.8525	0.9793	0.9970	0.9991	(94)
Ext temp.	642.6443	786.3810	915.7959	1021.4546	1017.9240	809.4732	553.6128	575.6104	770.0105	749.2497	643.4426	599.3738	(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	2436.7290	2357.4283	2127.5793	1761.9492	1345.5285	886.1095	565.3679	596.1512	958.2119	1476.7172	1988.8320	2424.0008	(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	1334.7991	1055.7438	901.5668	533.1561	243.7378	0.0000	0.0000	0.0000	0.0000	541.2359	968.6803	1357.5225	(98)
Space heating per m2	(98) / (4) =												50.6088 (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
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1543.3286	1214.9608	1245.0749	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7950	0.8738	0.8383	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1226.9395	1061.6815	1043.7796	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1425.6124	1364.6087	1271.4907	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	143.0445	225.3779	169.4171	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												537.8395	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	35.7611	56.3445	42.3543	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												134.4599	(107)
Space cooling per m2												0.9810	(108)
Energy for space heating												50.6088	(99)
Energy for space cooling												0.9810	(108)
Total												51.5898	(109)
Target Fabric Energy Efficiency (TFEE)												59.3	(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	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 347.4308 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate													4.8100
Number of sides sheltered													0.2405 (18)
													0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.2405 (21)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)	
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)	
Adj infilt rate													
	0.2646	0.2465	0.2465	0.2345	0.2345	0.2225	0.2225	0.2104	0.2104	0.2285	0.2225	0.2345 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5146	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			17.2200	1.3258	22.8295		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
Roof Window (Uw = 1.80)			1.4600	1.6791	2.4515		(27a)					
150mm EPS B&B			53.1200	0.1800	9.5616	75.0000	3984.0000 (28a)					
140mm Timber Frame	172.8600	21.4100	151.4500	0.1900	28.7755	9.0000	1363.0500 (29a)					
W2V	30.7800		30.7800	0.1400	4.3092	18.0000	554.0400 (29a)					
Dormer Cheek	10.5100	2.4500	8.0600	0.3200	2.5792	18.0000	145.0800 (29a)					
400mm Mineral Wool	14.3700		14.3700	0.1100	1.5807	9.0000	129.3300 (30)					
Sloping	43.0100	1.4600	41.5500	0.2000	8.3100	9.0000	373.9500 (30)					
Dormer Roof	4.3500		4.3500	0.2800	1.2180	9.0000	39.1500 (30)					
C2V	22.3000		22.3000	0.1400	3.1220	9.0000	200.7000 (30)					
Total net area of external elements Aum(A, m2)			351.3000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.4857		(33)					
Timber GF			74.7800			9.0000	673.0200 (32c)					
Timber FF			135.1700			9.0000	1216.5300 (32c)					
Timber 2F			38.0200			9.0000	342.1800 (32c)					
Internal Floor			53.1200			18.0000	956.1600 (32d)					
Internal Floor 2			30.8200			18.0000	554.7600 (32d)					
Internal Ceiling			53.1200			18.0000	956.1600 (32e)					
Internal Ceiling 2			30.8200			18.0000	554.7600 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			12042.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.8657 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.5664 (36)					
Total fabric heat loss					(33) + (36) =		112.0520 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 58.9943	Feb 57.3261	Mar 57.3261	Apr 57.3261	May 57.3261	Jun 57.3261	Jul 57.3261	Aug 57.3261	Sep 57.3261	Oct 57.3261	Nov 57.3261	Dec 57.3261 (38)
Heat transfer coeff	171.0463	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781 (39)
Average = Sum(39)m / 12 =	169.5171 (39)											
HLP	Jan 1.2480	Feb 1.2358	Mar 1.2358	Apr 1.2358	May 1.2358	Jun 1.2358	Jul 1.2358	Aug 1.2358	Sep 1.2358	Oct 1.2358	Nov 1.2358	Dec 1.2358 (40)
HLP (average)	1.2368 (40)											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy content	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)
Energy content (annual)												Total = Sum(45)m = 1625.9817 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2869	22.1161	22.8218	19.8966	19.0913	16.4743	15.2659	17.5178	17.7271	20.6592	22.5511	24.4890 (46)
Water storage loss:												210.0000 (47)
Store volume												1.4200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7668 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (56)
If cylinder contains dedicated solar storage	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935 (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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935 (64)
Total per year (kWh/year) = Sum(64)m =												2179.7597 (64)
RHI water heating demand												2180 (64)
Heat gains from water heating, kWh/month	93.6792	83.0093	88.2150	80.5170	79.9456	72.9309	71.4660	76.4578	75.7078	83.4211	86.4011	91.9106 (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	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2425	62.3887	50.7379	38.4119	28.7133	24.2410	26.1933	34.0470	45.6978	58.0238	67.7224	72.1947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	456.7817	461.5217	449.5771	424.1486	392.0496	361.8811	341.7267	336.9867	348.9313	374.3598	406.4588	436.6273 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789 (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)	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507 (71)
Water heating gains (Table 5)	125.9130	123.5258	118.5685	111.8292	107.4538	101.2929	96.0564	102.7658	105.1497	112.1251	120.0015	123.5357 (72)
Total internal gains	769.5414	764.0404	735.4878	690.9939	644.8209	604.0192	580.5805	590.4037	616.3830	661.1130	710.7869	748.9620 (73)

6. Solar gains

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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	19.5575	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501
alpha	2.3038	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167
util living area	0.9269	0.9039	0.8552	0.7724	0.6493	0.4727	0.3493	0.3632	0.5864	0.7893	0.8934	0.9350 (86)
MIT	18.6908	18.9586	19.4586	20.0275	20.5348	20.8500	20.9491	20.9447	20.7325	20.1606	19.3569	18.6565 (87)
Th 2	19.8818	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915 (88)
util rest of house	0.9164	0.8905	0.8345	0.7387	0.5931	0.3885	0.2411	0.2514	0.5056	0.7489	0.8756	0.9255 (89)
MIT 2	16.8582	17.2449	17.9536	18.7418	19.4127	19.7784	19.8691	19.8670	19.6629	18.9438	17.8229	16.8155 (90)
Living area fraction	17.0805	17.4527	18.1361	18.8977	19.5488	19.9084	20.0001	19.9977	19.7926	19.0914	18.0089	0.1213 (91)
MIT	17.0805	17.4527	18.1361	18.8977	19.5488	19.9084	20.0001	19.9977	19.7926	19.0914	18.0089	17.0387 (92)
Temperature adjustment	16.9305	17.3027	17.9861	18.7477	19.3988	19.7584	19.8501	19.8477	19.6426	18.9414	17.8589	-0.1500
adjusted MIT	16.9305	17.3027	17.9861	18.7477	19.3988	19.7584	19.8501	19.8477	19.6426	18.9414	17.8589	16.8887 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8765	0.8473	0.7886	0.6970	0.5648	0.3776	0.2368	0.2468	0.4852	0.7060	0.8309	0.8877	(94)
Useful gains	913.4912	992.9008	1049.6933	1037.1393	866.9790	602.0012	353.6016	352.2289	636.3980	812.3577	863.3109	859.4758	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	1972.2425	1931.3683	1759.1781	1481.6661	1066.8712	653.5243	364.1766	363.7710	735.5413	1175.7131	1602.1270	1928.9965	(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													
	787.7110	630.6501	527.8567	320.0593	148.7198	0.0000	0.0000	0.0000	0.0000	270.3364	531.9475	795.7234	(98)
Space heating												4013.0043	(98)
RHI space heating demand												4013	(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	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 347.4308 (5)

2. Ventilation rate

						main heating	secondary heating	other		total	m3 per hour			
Number of chimneys						0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues						0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans												0 * 10 =	0.0000 (7a)	
Number of passive vents												0 * 10 =	0.0000 (7b)	
Number of flueless gas fires												0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans											= (6a)+(6b)+(7a)+(7b)+(7c) =		0.0000 / (5) =	0.0000 (8)
Pressure test													Yes	
Measured/design AP50													4.8100	
Infiltration rate													0.2405 (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) =		0.2405 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	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														
	0.3066	0.3006	0.2946	0.2646	0.2585	0.2285	0.2285	0.2225	0.2405	0.2585	0.2706	0.2826 (22b)		
Mechanical extract ventilation - decentralised														
If mechanical ventilation:													0.5000 (23a)	
Effective ac	0.5566	0.5506	0.5446	0.5146	0.5085	0.5000	0.5000	0.5000	0.5000	0.5085	0.5206	0.5326 (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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			17.2200	1.3258	22.8295		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
Roof Window (Uw = 1.80)			1.4600	1.6791	2.4515		(27a)					
150mm EPS B&B			53.1200	0.1800	9.5616	75.0000	3984.0000 (28a)					
140mm Timber Frame	172.8600	21.4100	151.4500	0.1900	28.7755	9.0000	1363.0500 (29a)					
W2V	30.7800		30.7800	0.1400	4.3092	18.0000	554.0400 (29a)					
Dormer Cheek	10.5100	2.4500	8.0600	0.3200	2.5792	18.0000	145.0800 (29a)					
400mm Mineral Wool	14.3700		14.3700	0.1100	1.5807	9.0000	129.3300 (30)					
Sloping	43.0100	1.4600	41.5500	0.2000	8.3100	9.0000	373.9500 (30)					
Dormer Roof	4.3500		4.3500	0.2800	1.2180	9.0000	39.1500 (30)					
C2V	22.3000		22.3000	0.1400	3.1220	9.0000	200.7000 (30)					
Total net area of external elements Aum(A, m2)			351.3000				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	93.4857			(33)					
Timber GF			74.7800			9.0000	673.0200 (32c)					
Timber FF			135.1700			9.0000	1216.5300 (32c)					
Timber 2F			38.0200			9.0000	342.1800 (32c)					
Internal Floor			53.1200			18.0000	956.1600 (32d)					
Internal Floor 2			30.8200			18.0000	554.7600 (32d)					
Internal Ceiling			53.1200			18.0000	956.1600 (32e)					
Internal Ceiling 2			30.8200			18.0000	554.7600 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =	12042.8700		(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K					87.8657		(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)					18.5664		(36)					
Total fabric heat loss					(33) + (36) =	112.0520	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 63.8197	Feb 63.1303	Mar 62.4410	Apr 58.9943	May 58.3049	Jun 57.3261	Jul 57.3261	Aug 57.3261	Sep 57.3261	Oct 58.3049	Nov 59.6836	Dec 61.0623 (38)
Heat transfer coeff	175.8717	175.1824	174.4930	171.0463	170.3569	169.3781	169.3781	169.3781	169.3781	170.3569	171.7356	173.1143 (39)
Average = Sum(39)m / 12 =												171.6391 (39)
HLP	Jan 1.2832	Feb 1.2781	Mar 1.2731	Apr 1.2480	May 1.2429	Jun 1.2358	Jul 1.2358	Aug 1.2358	Sep 1.2358	Oct 1.2429	Nov 1.2530	Dec 1.2631 (40)
HLP (average)												1.2523 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy content	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)
Energy content (annual)												Total = Sum(45)m = 1625.9817 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2869	22.1161	22.8218	19.8966	19.0913	16.4743	15.2659	17.5178	17.7271	20.6592	22.5511	24.4890 (46)
Water storage loss:												210.0000 (47)
Store volume												1.4200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7668 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (56)
If cylinder contains dedicated solar storage	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935 (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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935 (64)
Heat gains from water heating, kWh/month	93.6792	83.0093	88.2150	80.5170	79.9456	72.9309	71.4660	76.4578	75.7078	83.4211	86.4011	91.9106 (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	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2425	62.3887	50.7379	38.4119	28.7133	24.2410	26.1933	34.0470	45.6978	58.0238	67.7224	72.1947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	456.7817	461.5217	449.5771	424.1486	392.0496	361.8811	341.7267	336.9867	348.9313	374.3598	406.4588	436.6273 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789 (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)	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507 (71)
Water heating gains (Table 5)	125.9130	123.5258	118.5685	111.8292	107.4538	101.2929	96.0564	102.7658	105.1497	112.1251	120.0015	123.5357 (72)
Total internal gains	769.5414	764.0404	735.4878	690.9939	644.8209	604.0192	580.5805	590.4037	616.3830	661.1130	710.7869	748.9620 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				8.2400	10.6334		0.7200		0.7000		0.7700		30.6029 (74)
East				4.2500	19.6403		0.7200		0.7000		0.7700		29.1541 (76)
South				4.1300	46.7521		0.7200		0.7000		0.7700		67.4395 (78)
West				0.6000	19.6403		0.7200		0.7000		0.7700		4.1159 (80)
South				4.5200	46.7521		0.7200		0.7000		0.7700		73.8079 (78)
West				1.4600	26.0000		0.6300		0.7000		1.0000		15.0663 (82)
Solar gains	220.1867	386.1855	556.8599	735.9081	864.9153	876.1918	837.4721	738.7741	618.5993	434.5970	265.7855		187.0915 (83)
Total gains	989.7281	1150.2259	1292.3477	1426.9019	1509.7362	1480.2111	1418.0526	1329.1778	1234.9823	1095.7100	976.5724		936.0535 (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	19.0209	19.0958	19.1712	19.5575	19.6367	19.7501	19.7501	19.7501	19.7501	19.6367	19.4790	19.3239
alpha	2.2681	2.2731	2.2781	2.3038	2.3091	2.3167	2.3167	2.3167	2.3167	2.3091	2.2986	2.2883
util living area	0.9421	0.9186	0.8810	0.8136	0.7144	0.5845	0.4618	0.5014	0.6790	0.8420	0.9201	0.9481 (86)
MIT	18.3149	18.6331	19.1292	19.7673	20.3128	20.7018	20.8769	20.8464	20.5502	19.8461	18.9844	18.2736 (87)
Th 2	19.8540	19.8580	19.8620	19.8818	19.8858	19.8915	19.8915	19.8915	19.8915	19.8858	19.8778	19.8699 (88)
util rest of house	0.9340	0.9074	0.8642	0.7862	0.6697	0.5133	0.3644	0.4043	0.6149	0.8128	0.9073	0.9408 (89)
MIT 2	16.3024	16.7604	17.4709	18.3789	19.1225	19.6192	19.8102	19.7838	19.4493	18.5100	17.2834	16.2505 (90)
Living area fraction	16.5464	16.9875	17.6720	18.5472	19.2669	19.7505	19.9395	19.9127	19.5828	18.6721	17.4897	16.4959 (92)
Temperature adjustment	16.3964	16.8375	17.5220	18.3972	19.1169	19.6005	19.7895	19.7627	19.4328	18.5221	17.3397	-0.1500
adjusted MIT	16.3964	16.8375	17.5220	18.3972	19.1169	19.6005	19.7895	19.7627	19.4328	18.5221	17.3397	16.3459 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8973	0.8653	0.8179	0.7411	0.6337	0.4925	0.3547	0.3919	0.5840	0.7666	0.8657	0.9064	(94)
Useful gains	888.0821	995.3368	1057.0375	1057.5061	956.6778	729.0551	502.9584	520.9349	721.1991	840.0225	845.3710	848.4192	(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	2127.4226	2091.2376	1923.2592	1624.4656	1263.5162	846.9774	540.2326	569.5600	903.2594	1349.5765	1758.5172	2102.6229	(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	922.0693	736.4454	644.4690	408.2108	228.2877	0.0000	0.0000	0.0000	0.0000	379.1081	657.4652	933.1276	(98)
Space heating												4909.1831	(98)
Space heating per m2											(98) / (4) =	35.8178	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.6000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5418.5244	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	922.0693	736.4454	644.4690	408.2108	228.2877	0.0000	0.0000	0.0000	0.0000	379.1081	657.4652	933.1276	(98)	
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)	
Space heating fuel (main heating system)	1017.7365	812.8536	711.3344	450.5638	251.9732	0.0000	0.0000	0.0000	0.0000	418.4416	725.6791	1029.9422	(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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935	(64)	
Efficiency of water heater	88.3575	88.1790	87.8233	87.0577	85.6348	79.9000	79.9000	79.9000	79.9000	86.7916	87.8983	88.4222	(217)	
Fuel for water heating, kWh/month	244.0231	215.3827	226.7950	204.6461	203.5487	194.4242	186.2401	205.0298	204.8766	212.8790	222.8220	237.8288	(219)	
Water heating fuel used												2558.4960	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5418.5244	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)														
mechanical ventilation fans (SFP = 0.2308)													97.8330	(230a)
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													172.8330	(231)
Electricity for lighting (calculated in Appendix L)													496.2015	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118	(233)	
Total delivered energy for all uses												7800.1431	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5418.5244	3.4800	188.5647	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2558.4960	3.4800	89.0357	(247)
Mechanical ventilation fans	97.8330	13.1900	12.9042	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	496.2015	13.1900	65.4490	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-845.9118	13.1900	-111.5758	(252)
Total energy cost			374.2702	(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] =	0.8634	(257)
SAP value			87.9553	
SAP rating (Section 12)			88	(258)
SAP band			B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5418.5244	0.2160	1170.4013 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2558.4960	0.2160	552.6351 (264)
Space and water heating			1723.0364 (265)
Pumps and fans	172.8330	0.5190	89.7003 (267)
Energy for lighting	496.2015	0.5190	257.5286 (268)
Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total kg/year			1631.2371 (272)
CO2 emissions per m2			11.9000 (273)
EI value			87.9938
EI rating			88 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8498 = 4.095$, stars = 4
Water heating environmental impact	$0.216 / 0.8498 = 0.2542$, 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	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 347.4308 (5)

2. Ventilation rate

	main heating				secondary heating				other		total	m3 per hour	
Number of chimneys					0	+		0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+		0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans												0 * 10 =	0.0000 (7a)
Number of passive vents												0 * 10 =	0.0000 (7b)
Number of flueless gas fires												0 * 40 =	0.0000 (7c)
												Air changes per hour	
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										0.0000 / (5) =	0.0000 (8)	
Pressure test											Yes		
Measured/design AP50											4.8100		
Infiltration rate											0.2405 (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) =	0.2405 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000	(22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750	(22a)
Adj infilt rate													
	0.2646	0.2465	0.2465	0.2345	0.2345	0.2225	0.2225	0.2104	0.2104	0.2285	0.2225	0.2345	(22b)
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5146	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	(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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			17.2200	1.3258	22.8295		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
Roof Window (Uw = 1.80)			1.4600	1.6791	2.4515		(27a)					
150mm EPS B&B			53.1200	0.1800	9.5616	75.0000	3984.0000 (28a)					
140mm Timber Frame	172.8600	21.4100	151.4500	0.1900	28.7755	9.0000	1363.0500 (29a)					
W2V	30.7800		30.7800	0.1400	4.3092	18.0000	554.0400 (29a)					
Dormer Cheek	10.5100	2.4500	8.0600	0.3200	2.5792	18.0000	145.0800 (29a)					
400mm Mineral Wool	14.3700		14.3700	0.1100	1.5807	9.0000	129.3300 (30)					
Sloping	43.0100	1.4600	41.5500	0.2000	8.3100	9.0000	373.9500 (30)					
Dormer Roof	4.3500		4.3500	0.2800	1.2180	9.0000	39.1500 (30)					
C2V	22.3000		22.3000	0.1400	3.1220	9.0000	200.7000 (30)					
Total net area of external elements Aum(A, m2)			351.3000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	93.4857		(33)					
Timber GF			74.7800			9.0000	673.0200 (32c)					
Timber FF			135.1700			9.0000	1216.5300 (32c)					
Timber 2F			38.0200			9.0000	342.1800 (32c)					
Internal Floor			53.1200			18.0000	956.1600 (32d)					
Internal Floor 2			30.8200			18.0000	554.7600 (32d)					
Internal Ceiling			53.1200			18.0000	956.1600 (32e)					
Internal Ceiling 2			30.8200			18.0000	554.7600 (32e)					
Heat capacity Cm = Sum(A x k)				(28)...(30) + (32) + (32a)...(32e) =			12042.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.8657 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.5664 (36)					
Total fabric heat loss					(33) + (36) =		112.0520 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 58.9943	Feb 57.3261	Mar 57.3261	Apr 57.3261	May 57.3261	Jun 57.3261	Jul 57.3261	Aug 57.3261	Sep 57.3261	Oct 57.3261	Nov 57.3261	Dec 57.3261 (38)
Heat transfer coeff	171.0463	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781 (39)
Average = Sum(39)m / 12 =	169.5171 (39)											
HLP	Jan 1.2480	Feb 1.2358	Mar 1.2358	Apr 1.2358	May 1.2358	Jun 1.2358	Jul 1.2358	Aug 1.2358	Sep 1.2358	Oct 1.2358	Nov 1.2358	Dec 1.2358 (40)
HLP (average)	1.2368 (40)											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

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4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy content	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)
Energy content (annual)												Total = Sum(45)m = 1625.9817 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2869	22.1161	22.8218	19.8966	19.0913	16.4743	15.2659	17.5178	17.7271	20.6592	22.5511	24.4890 (46)
Water storage loss:												210.0000 (47)
Store volume												1.4200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7668 (55)
Enter (49) or (54) in (55)												
Total storage loss	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (56)
If cylinder contains dedicated solar storage	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935 (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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935 (64)
Total per year (kWh/year) = Sum(64)m =												2179.7597 (64)
Heat gains from water heating, kWh/month	93.6792	83.0093	88.2150	80.5170	79.9456	72.9309	71.4660	76.4578	75.7078	83.4211	86.4011	91.9106 (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	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2425	62.3887	50.7379	38.4119	28.7133	24.2410	26.1933	34.0470	45.6978	58.0238	67.7224	72.1947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	456.7817	461.5217	449.5771	424.1486	392.0496	361.8811	341.7267	336.9867	348.9313	374.3598	406.4588	436.6273 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789 (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)	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507 (71)
Water heating gains (Table 5)	125.9130	123.5258	118.5685	111.8292	107.4538	101.2929	96.0564	102.7658	105.1497	112.1251	120.0015	123.5357 (72)
Total internal gains	769.5414	764.0404	735.4878	690.9939	644.8209	604.0192	580.5805	590.4037	616.3830	661.1130	710.7869	748.9620 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				8.2400	13.4839	0.7200	0.7000		0.7700		38.8067 (74)	
East				4.2500	25.1925	0.7200	0.7000		0.7700		37.3960 (76)	
South				4.1300	56.7559	0.7200	0.7000		0.7700		81.8700 (78)	
West				0.6000	25.1925	0.7200	0.7000		0.7700		5.2794 (80)	
South				4.5200	56.7559	0.7200	0.7000		0.7700		89.6010 (78)	
West				1.4600	34.0000	0.6300	0.7000		1.0000		19.7021 (82)	
Solar gains	272.6551	407.8043	595.5299	797.0064	890.0797	990.4187	912.6056	837.0380	695.3051	489.5894	328.2007	219.2227 (83)
Total gains	1042.1965	1171.8447	1331.0177	1488.0002	1534.9007	1594.4379	1493.1861	1427.4418	1311.6880	1150.7024	1038.9876	968.1847 (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	19.5575	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501
alpha	2.3038	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167
util living area	0.9269	0.9039	0.8552	0.7724	0.6493	0.4727	0.3493	0.3632	0.5864	0.7893	0.8934	0.9350 (86)
MIT	18.6908	18.9586	19.4586	20.0275	20.5348	20.8500	20.9491	20.9447	20.7325	20.1606	19.3569	18.6565 (87)
Th 2	19.8818	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915 (88)
util rest of house	0.9164	0.8905	0.8345	0.7387	0.5931	0.3885	0.2411	0.2514	0.5056	0.7489	0.8756	0.9255 (89)
MIT 2	16.8582	17.2449	17.9536	18.7418	19.4127	19.7784	19.8691	19.8670	19.6629	18.9438	17.8229	16.8155 (90)
Living area fraction												fLA = Living area / (4) = 0.1213 (91)
MIT	17.0805	17.4527	18.1361	18.8977	19.5488	19.9084	20.0001	19.9977	19.7926	19.0914	18.0089	17.0387 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9305	17.3027	17.9861	18.7477	19.3988	19.7584	19.8501	19.8477	19.6426	18.9414	17.8589	16.8887 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8765	0.8473	0.7886	0.6970	0.5648	0.3776	0.2368	0.2468	0.4852	0.7060	0.8309	0.8877	(94)
Useful gains	913.4912	992.9008	1049.6933	1037.1393	866.9790	602.0012	353.6016	352.2289	636.3980	812.3577	863.3109	859.4758	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1972.2425	1931.3683	1759.1781	1481.6661	1066.8712	653.5243	364.1766	363.7710	735.5413	1175.7131	1602.1270	1928.9965	(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	787.7110	630.6501	527.8567	320.0593	148.7198	0.0000	0.0000	0.0000	0.0000	270.3364	531.9475	795.7234	(98)
Space heating												4013.0043	(98)
Space heating per m2												(98) / (4) =	29.2792 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.6000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4429.3645 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	787.7110	630.6501	527.8567	320.0593	148.7198	0.0000	0.0000	0.0000	0.0000	270.3364	531.9475	795.7234	(98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000	(210)
Space heating fuel (main heating system)	869.4381	696.0818	582.6233	353.2664	164.1499	0.0000	0.0000	0.0000	0.0000	298.3845	587.1385	878.2819	(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	215.6127	189.9223	199.1788	178.1602	174.3085	155.3449	148.8058	163.8188	163.6964	184.7610	195.8567	210.2935	(64)
Efficiency of water heater	88.0656	87.8762	87.3937	86.4596	84.4942	79.9000	79.9000	79.9000	79.9000	85.9283	87.4485	88.1329	(216)
(217)m	88.0656	87.8762	87.3937	86.4596	84.4942	79.9000	79.9000	79.9000	79.9000	85.9283	87.4485	88.1329	(217)
Fuel for water heating, kWh/month	244.8320	216.1248	227.9098	206.0618	206.2964	194.4242	186.2401	205.0298	204.8766	215.0178	223.9680	238.6096	(219)
Water heating fuel used												2569.3907	(219)
Annual totals kWh/year													
Space heating fuel - main system												4429.3645	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)													
mechanical ventilation fans (SFP = 0.2308)													97.8330 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													172.8330 (231)
Electricity for lighting (calculated in Appendix L)													496.2015 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1179 * 1.00) =										-933.8290		-933.8290	(233)
Total delivered energy for all uses												6733.9607	(238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4429.3645	7.6100	337.0746	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2569.3907	7.6100	195.5306	(247)
Mechanical ventilation fans	97.8330	31.0800	30.4065	(249)
Pumps and fans for heating	75.0000	31.0800	23.3100	(249)
Energy for lighting	496.2015	31.0800	154.2194	(250)
Additional standing charges			105.0000	(251)
Energy saving/generation technologies				
PV Unit	-933.8290	31.0800	-290.2340	(252)
Total energy cost			555.3071	(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	4429.3645	0.2160	956.7427	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2569.3907	0.2160	554.9884	(264)
Space and water heating			1511.7311	(265)
Pumps and fans	172.8330	0.5190	89.7003	(267)
Energy for lighting	496.2015	0.5190	257.5286	(268)
Energy saving/generation technologies				

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PV Unit	-933.8290	0.5190	-484.6572 (269)
Total kg/year			1374.3028 (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	4429.3645	1.2200	5403.8247 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2569.3907	1.2200	3134.6566 (264)
Space and water heating			8538.4814 (265)
Pumps and fans	172.8330	3.0700	530.5972 (267)
Energy for lighting	496.2015	3.0700	1523.3385 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	3.0700	-2866.8549 (269)
Primary energy kWh/year			7725.5622 (272)
Primary energy kWh/m2/year			56.3663 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 88	-269 kg (19.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£88 1.96 kg/m²	B 89	B 90
Total Savings	£88 1.96 kg/m²		

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

Fuel prices for cost data on this page from database revision number 535 TEST (04 Jan 2024)
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	£208	£223	-£16
Mains gas	£638	£534	£104
Space heating	£496	£498	-£2
Water heating	£196	£105	£90
Lighting	£154	£154	£0
Generated (PV)	-£290	-£290	£0
Total cost of fuels	£556	£467	£88
Total cost of uses	£556	£467	£88
Delivered energy	49 kWh/m²	40 kWh/m²	10 kWh/m²

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Carbon dioxide emissions	1.4 tonnes	1.1 tonnes	0.3 tonnes
CO2 emissions per m ²	10 kg/m ²	8 kg/m ²	2 kg/m ²
Primary energy	56 kWh/m ²	45 kWh/m ²	11 kWh/m ²

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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	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 347.4308 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					0 * 10 = 0.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				0.0000 / (5) = 0.0000 (8)
Pressure test					Yes
Measured/design AP50					4.8100
Infiltration rate					0.2405 (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) =				0.2405 (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	0.3066	0.3006	0.2946	0.2646	0.2585	0.2285	0.2285	0.2225	0.2405	0.2585	0.2706	0.2826 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
Effective ac	0.5566	0.5506	0.5446	0.5146	0.5085	0.5000	0.5000	0.5000	0.5000	0.5085	0.5206	0.5326 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			17.2200	1.3258	22.8295		(27)
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)
Roof Window (Uw = 1.80)			1.4600	1.6791	2.4515		(27a)
150mm EPS B&B			53.1200	0.1800	9.5616	75.0000	3984.0000 (28a)
140mm Timber Frame	172.8600	21.4100	151.4500	0.1900	28.7755	9.0000	1363.0500 (29a)
W2V	30.7800		30.7800	0.1400	4.3092	18.0000	554.0400 (29a)
Dormer Cheek	10.5100	2.4500	8.0600	0.3200	2.5792	18.0000	145.0800 (29a)
400mm Mineral Wool	14.3700		14.3700	0.1100	1.5807	9.0000	129.3300 (30)
Sloping	43.0100	1.4600	41.5500	0.2000	8.3100	9.0000	373.9500 (30)
Dormer Roof	4.3500		4.3500	0.2800	1.2180	9.0000	39.1500 (30)
C2V	22.3000		22.3000	0.1400	3.1220	9.0000	200.7000 (30)
Total net area of external elements Aum(A, m ²)			351.3000				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	93.4857	(33)
Timber GF			74.7800			9.0000	673.0200 (32c)
Timber FF			135.1700			9.0000	1216.5300 (32c)
Timber 2F			38.0200			9.0000	342.1800 (32c)
Internal Floor			53.1200			18.0000	956.1600 (32d)
Internal Floor 2			30.8200			18.0000	554.7600 (32d)
Internal Ceiling			53.1200			18.0000	956.1600 (32e)
Internal Ceiling 2			30.8200			18.0000	554.7600 (32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12042.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K		87.8657 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		18.5664 (36)
Total fabric heat loss	(33) + (36) =	112.0520 (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	63.8197	63.1303	62.4410	58.9943	58.3049	57.3261	57.3261	57.3261	57.3261	58.3049	59.6836	61.0623 (38)
Average = Sum(39)m / 12 =	175.8717	175.1824	174.4930	171.0463	170.3569	169.3781	169.3781	169.3781	169.3781	170.3569	171.7356	173.1143 (39)
												171.6391 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2832	1.2781	1.2731	1.2480	1.2429	1.2358	1.2358	1.2358	1.2358	1.2429	1.2530	1.2631 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy content	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)
Energy content (annual)												Total = Sum(45)m = 1625.9817 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2869	22.1161	22.8218	19.8966	19.0913	16.4743	15.2659	17.5178	17.7271	20.6592	22.5511	24.4890 (46)
Water storage loss:												
Store volume												210.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.4200 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.7668 (55)
Total storage loss	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (56)
If cylinder contains dedicated solar storage	15.2812	13.8024	15.2812	14.7883	15.2812	14.7883	15.2812	15.2812	14.7883	15.2812	14.7883	15.2812 (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	207.1231	182.2543	189.2935	163.1909	153.0246	134.5225	127.2893	143.2328	150.0778	174.8757	187.6410	201.8039 (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												1.1154 (H8)
Utilisation factor												0.5920 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												103.3426 (H14)
Volume ratio Veff/V												1.1176 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-944.0945 (H17)
Solar input	-27.3769	-45.6841	-77.8053	-104.2744	-128.8222	-126.6528	-124.9790	-109.1948	-85.5214	-58.4011	-32.4729	-22.9098 (63)
Solar input (sum of months) = Sum(63)m =												-944.0945 (63)
Output from w/h	179.7463	136.5702	111.4882	58.9165	24.2024	7.8697	2.3103	34.0380	64.5564	116.4747	155.1681	178.8941 (64)
Heat gains from water heating, kWh/month	86.8876	76.8749	80.3067	68.5416	62.9185	56.2730	54.2527	59.9890	64.8129	75.5128	79.8285	85.1189 (65)
Total per year (kWh/year) = Sum(64)m =												1070.2349 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2425	62.3887	50.7379	38.4119	28.7133	24.2410	26.1933	34.0470	45.6978	58.0238	67.7224	72.1947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	456.7817	461.5217	449.5771	424.1486	392.0496	361.8811	341.7267	336.9867	348.9313	374.3598	406.4588	436.6273 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789 (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)	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507 (71)
Water heating gains (Table 5)	116.7844	114.3972	107.9391	95.1966	84.5679	78.1569	72.9204	80.6303	90.0179	101.4957	110.8729	114.4072 (72)
Total internal gains	760.4128	754.9118	724.8584	674.3613	621.9350	580.8832	557.4445	568.2682	601.2512	650.4836	701.6583	739.8334 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	

North						8.2400	10.6334		0.7200	0.7000	0.7700	30.6029 (74)	
East						4.2500	19.6403		0.7200	0.7000	0.7700	29.1541 (76)	
South						4.1300	46.7521		0.7200	0.7000	0.7700	67.4395 (78)	
West						0.6000	19.6403		0.7200	0.7000	0.7700	4.1159 (80)	
South						4.5200	46.7521		0.7200	0.7000	0.7700	73.8079 (78)	
West						1.4600	26.0000		0.6300	0.7000	1.0000	15.0663 (82)	

Solar gains	220.1867	386.1855	556.8599	735.9081	864.9153	876.1918	837.4721	738.7741	618.5993	434.5970	265.7855	187.0915 (83)	
Total gains	980.5995	1141.0973	1281.7183	1410.2693	1486.8503	1457.0750	1394.9166	1307.0423	1219.8505	1085.0806	967.4438	926.9249 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	19.0209	19.0958	19.1712	19.5575	19.6367	19.7501	19.7501	19.7501	19.7501	19.6367	19.4790	19.3239
alpha	2.2681	2.2731	2.2781	2.3038	2.3091	2.3167	2.3167	2.3167	2.3167	2.3091	2.2986	2.2883
util living area	0.9431	0.9197	0.8826	0.8167	0.7196	0.5904	0.4677	0.5076	0.6834	0.8443	0.9214	0.9490 (86)
MIT	18.3046	18.6236	19.1194	19.7550	20.3011	20.6951	20.8735	20.8423	20.5435	19.8374	18.9748	18.2631 (87)
Th 2	19.8540	19.8580	19.8620	19.8818	19.8858	19.8915	19.8915	19.8915	19.8915	19.8858	19.8778	19.8699 (88)
util rest of house	0.9351	0.9087	0.8659	0.7896	0.6751	0.5192	0.3696	0.4099	0.6195	0.8155	0.9088	0.9419 (89)
MIT 2	16.2878	16.7470	17.4573	18.3625	19.1083	19.6125	19.8077	19.7806	19.4419	18.4985	17.2699	16.2355 (90)
Living area fraction	16.5324	16.9745	17.6588	18.5314	19.2529	19.7438	19.9369	19.9093	fLA = Living area / (4) =			0.1213 (91)
MIT	16.5324	16.9745	17.6588	18.5314	19.2529	19.7438	19.9369	19.9093	19.5755	18.6609	17.4766	16.4814 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.3824	16.8245	17.5088	18.3814	19.1029	19.5938	19.7869	19.7593	19.4255	18.5109	17.3266	16.3314 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8987	0.8668	0.8198	0.7444	0.6386	0.4978	0.3595	0.3971	0.5881	0.7692	0.8674	0.9078 (94)
Useful gains	881.2628	989.1115	1050.7302	1049.7846	949.5153	725.3424	501.4647	519.0380	717.3813	834.6645	839.1518	841.4321 (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	2124.9496	2088.9679	1920.9652	1621.7507	1261.1353	845.8379	539.7949	568.9968	902.0229	1347.6748	1756.2746	2100.1206 (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	925.3030	739.1035	647.4548	411.8156	231.8452	0.0000	0.0000	0.0000	0.0000	381.6797	660.3284	936.4642 (98)
Space heating												4933.9944 (98)
Space heating per m2										(98) / (4) =		35.9988 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5445.9100 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	925.3030	739.1035	647.4548	411.8156	231.8452	0.0000	0.0000	0.0000	0.0000	381.6797	660.3284	936.4642 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1021.3057	815.7875	714.6300	454.5426	255.8998	0.0000	0.0000	0.0000	0.0000	421.2800	728.8393	1033.6250 (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	179.7463	136.5702	111.4882	58.9165	24.2024	7.8697	2.3103	34.0380	64.5564	116.4747	155.1681	178.8941 (64)
Efficiency of water heater (217)m	88.6685	88.7465	88.8521	89.1065	89.4675	79.9000	79.9000	79.9000	79.9000	87.8493	88.3488	79.9000 (216)
Fuel for water heating, kWh/month	202.7171	153.8881	125.4762	66.1192	27.0516	9.8495	2.8915	42.6007	80.7965	132.5846	175.6313	201.6961 (219)
Water heating fuel used												1221.3024 (219)
Annual totals kWh/year												
Space heating fuel - main system												5445.9100 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												97.8330 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												222.8330 (231)
Electricity for lighting (calculated in Appendix L)												496.2015 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118 (233)
Total delivered energy for all uses												6540.3350 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5445.9100	3.4800	189.5177 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1221.3024	3.4800	42.5013 (247)
Mechanical ventilation fans	97.8330	13.1900	12.9042 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Pump for solar water heating	50.0000	13.1900	6.5950 (249)
Energy for lighting	496.2015	13.1900	65.4490 (250)
Additional standing charges			120.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy saving/generation technologies			
PV Unit	-845.9118	13.1900	-111.5758 (252)
Total energy cost			335.2839 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7735 (257)
SAP value		89.2100
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	5445.9100	0.2160	1176.3166 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1221.3024	0.2160	263.8013 (264)
Space and water heating			1440.1179 (265)
Pumps and fans	222.8330	0.5190	115.6503 (267)
Energy for lighting	496.2015	0.5190	257.5286 (268)
Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total kg/year			1374.2685 (272)
CO2 emissions per m2			10.0300 (273)
EI value			89.8851
EI rating			90 (274)
EI band			B

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	53.1200 (1b)	x 2.4000 (2b)	= 127.4880 (1b) - (3b)
First floor	53.1200 (1c)	x 2.6900 (2c)	= 142.8928 (1c) - (3c)
Second floor	30.8200 (1d)	x 2.5000 (2d)	= 77.0500 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.0600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 347.4308 (5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour			
Number of chimneys		0	+	0	+	0	=	0 * 40 =	0.0000 (6a)			
Number of open flues		0	+	0	+	0	=	0 * 20 =	0.0000 (6b)			
Number of intermittent fans								0 * 10 =	0.0000 (7a)			
Number of passive vents								0 * 10 =	0.0000 (7b)			
Number of flueless gas fires								0 * 40 =	0.0000 (7c)			
									Air changes per hour			
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =							0.0000 / (5) =	0.0000 (8)			
Pressure test								Yes				
Measured/design AP50								4.8100				
Infiltration rate								0.2405	(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) =	0.2405 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2646	0.2465	0.2465	0.2345	0.2345	0.2225	0.2225	0.2104	0.2104	0.2285	0.2225	0.2345 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5146	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			17.2200	1.3258	22.8295		(27)					
French Door (Uw = 1.40)			4.5200	1.3258	5.9924		(27)					
Roof Window (Uw = 1.80)			1.4600	1.6791	2.4515		(27a)					
150mm EPS B&B			53.1200	0.1800	9.5616	75.0000	3984.0000 (28a)					
140mm Timber Frame	172.8600	21.4100	151.4500	0.1900	28.7755	9.0000	1363.0500 (29a)					
W2V	30.7800		30.7800	0.1400	4.3092	18.0000	554.0400 (29a)					
Dormer Cheek	10.5100	2.4500	8.0600	0.3200	2.5792	18.0000	145.0800 (29a)					
400mm Mineral Wool	14.3700		14.3700	0.1100	1.5807	9.0000	129.3300 (30)					
Sloping	43.0100	1.4600	41.5500	0.2000	8.3100	9.0000	373.9500 (30)					
Dormer Roof	4.3500		4.3500	0.2800	1.2180	9.0000	39.1500 (30)					
C2V	22.3000		22.3000	0.1400	3.1220	9.0000	200.7000 (30)					
Total net area of external elements Aum(A, m2)			351.3000				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	93.4857	(33)					
Timber GF			74.7800			9.0000	673.0200 (32c)					
Timber FF			135.1700			9.0000	1216.5300 (32c)					
Timber 2F			38.0200			9.0000	342.1800 (32c)					
Internal Floor			53.1200			18.0000	956.1600 (32d)					
Internal Floor 2			30.8200			18.0000	554.7600 (32d)					
Internal Ceiling			53.1200			18.0000	956.1600 (32e)					
Internal Ceiling 2			30.8200			18.0000	554.7600 (32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12042.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							87.8657 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.5664 (36)					
Total fabric heat loss					(33) + (36) =		112.0520 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 58.9943	Feb 57.3261	Mar 57.3261	Apr 57.3261	May 57.3261	Jun 57.3261	Jul 57.3261	Aug 57.3261	Sep 57.3261	Oct 57.3261	Nov 57.3261	Dec 57.3261 (38)
Heat transfer coeff	171.0463	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781	169.3781 (39)
Average = Sum(39)m / 12 =	169.5171 (39)											
HLP	Jan 1.2480	Feb 1.2358	Mar 1.2358	Apr 1.2358	May 1.2358	Jun 1.2358	Jul 1.2358	Aug 1.2358	Sep 1.2358	Oct 1.2358	Nov 1.2358	Dec 1.2358 (40)
HLP (average)	1.2368 (40)											
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9113 (42)
Average daily hot water use (litres/day)												103.3426 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.6769	109.5432	105.4095	101.2758	97.1421	93.0084	93.0084	97.1421	101.2758	105.4095	109.5432	113.6769 (44)
Energy content	168.5795	147.4407	152.1456	132.6442	127.2753	109.8289	101.7726	116.7856	118.1804	137.7278	150.3407	163.2603 (45)
Energy content (annual)												Total = Sum(45)m = 1625.9817 (45)
Distribution loss (46)m = 0.15 x (45)m	25.2869	22.1161	22.8218	19.8966	19.0913	16.4743	15.2659	17.5178	17.7271	20.6592	22.5511	24.4890 (46)
Water storage loss:												210.0000 (47)
Store volume												1.4200 (48)
a) If manufacturer declared loss factor is known (kWh/day):												0.5400 (49)
Temperature factor from Table 2b												0.7668 (55)
Enter (49) or (54) in (55)												0.7668 (55)
Total storage loss	23.7708	21.4704	23.7708	23.0040	23.7708	23.0040	23.7708	23.7708	23.0040	23.7708	23.0040	23.7708 (56)
If cylinder contains dedicated solar storage	15.2812	13.8024	15.2812	14.7883	15.2812	14.7883	15.2812	15.2812	14.7883	15.2812	14.7883	15.2812 (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	207.1231	182.2543	189.2935	163.1909	153.0246	134.5225	127.2893	143.2328	150.0778	174.8757	187.6410	201.8039 (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												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2405 (H8)
Utilisation factor												0.5534 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												115.5000 (H13)
Daily hot water demand												103.3426 (H14)
Volume ratio Veff/V												1.1176 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-981.5104 (H17)
Solar input	-32.2208	-45.8160	-78.7466	-106.2474	-124.1762	-133.8844	-127.4474	-116.1600	-90.7676	-62.4216	-38.1087	-25.5136 (63)
Solar input (sum of months) = Sum(63)m =												-981.5104 (63)
Output from w/h	174.9023	136.4384	110.5469	56.9435	28.8484	0.6381	0.0000	27.0728	59.3102	112.4541	149.5322	176.2903 (64)
Total per year (kWh/year) = Sum(64)m =												1032.9771 (64)
Heat gains from water heating, kWh/month	86.8876	76.8749	80.3067	68.5416	62.9185	56.2730	54.2527	59.9890	64.8129	75.5128	79.8285	85.1189 (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	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761	174.6761 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2425	62.3887	50.7379	38.4119	28.7133	24.2410	26.1933	34.0470	45.6978	58.0238	67.7224	72.1947 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	456.7817	461.5217	449.5771	424.1486	392.0496	361.8811	341.7267	336.9867	348.9313	374.3598	406.4588	436.6273 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789	55.3789 (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)	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507	-116.4507 (71)
Water heating gains (Table 5)	116.7844	114.3972	107.9391	95.1966	84.5679	78.1569	72.9204	80.6303	90.0179	101.4957	110.8729	114.4072 (72)
Total internal gains	760.4128	754.9118	724.8584	674.3613	621.9350	580.8832	557.4445	568.2682	601.2512	650.4836	701.6583	739.8334 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				8.2400	13.4839		0.7200		0.7000		0.7700		38.8067 (74)
East				4.2500	25.1925		0.7200		0.7000		0.7700		37.3960 (76)
South				4.1300	56.7559		0.7200		0.7000		0.7700		81.8700 (78)
West				0.6000	25.1925		0.7200		0.7000		0.7700		5.2794 (80)
South				4.5200	56.7559		0.7200		0.7000		0.7700		89.6010 (78)
West				1.4600	34.0000		0.6300		0.7000		1.0000		19.7021 (82)
Solar gains	272.6551	407.8043	595.5299	797.0064	890.0797	990.4187	912.6056	837.0380	695.3051	489.5894	328.2007	219.2227	(83)
Total gains	1033.0679	1162.7161	1320.3883	1471.3676	1512.0148	1571.3019	1470.0501	1405.3063	1296.5563	1140.0730	1029.8590	959.0561	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)	21.0000 (85)
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	19.5575	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501	19.7501
alpha	2.3038	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167	2.3167
util living area												
	0.9280	0.9052	0.8571	0.7759	0.6548	0.4780	0.3541	0.3680	0.5907	0.7920	0.8950	0.9362 (86)
MIT	18.6810	18.9494	19.4495	20.0169	20.5258	20.8464	20.9476	20.9431	20.7281	20.1533	19.3481	18.6463 (87)
Th 2	19.8818	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915	19.8915 (88)
util rest of house												
	0.9177	0.8920	0.8365	0.7424	0.5988	0.3933	0.2446	0.2551	0.5098	0.7519	0.8774	0.9268 (89)
MIT 2	16.8443	17.2320	17.9412	18.7281	19.4026	19.7755	19.8684	19.8662	19.6587	18.9347	17.8106	16.8010 (90)
Living area fraction									fLA = Living area / (4) =			0.1213 (91)
MIT	17.0670	17.4403	18.1241	18.8843	19.5388	19.9053	19.9993	19.9968	19.7884	19.0825	17.9970	17.0248 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.9170	17.2903	17.9741	18.7343	19.3888	19.7553	19.8493	19.8468	19.6384	18.9325	17.8470	16.8748 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8780	0.8489	0.7906	0.7004	0.5699	0.3820	0.2402	0.2503	0.4890	0.7087	0.8328	0.8893 (94)
Useful gains	907.0793	987.0177	1043.9590	1030.5368	861.6852	600.2270	353.1376	351.7270	634.0729	808.0025	857.7043	852.8608 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W												
	1969.9413	1929.2635	1757.1427	1479.4059	1065.1853	653.0063	364.0396	363.6224	734.8266	1174.2096	1600.1198	1926.6420 (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												
	790.7693	633.1892	530.6087	323.1857	151.4041	0.0000	0.0000	0.0000	0.0000	272.4581	534.5392	798.8932 (98)
Space heating												4035.0475 (98)
Space heating per m2										(98) / (4) =		29.4400 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4453.6949 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	790.7693	633.1892	530.6087	323.1857	151.4041	0.0000	0.0000	0.0000	0.0000	272.4581	534.5392	798.8932 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	872.8138	698.8843	585.6608	356.7171	167.1127	0.0000	0.0000	0.0000	0.0000	300.7264	589.9991	881.7806 (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	174.9023	136.4384	110.5469	56.9435	28.8484	0.6381	0.0000	27.0728	59.3102	112.4541	149.5322	176.2903 (64)
Efficiency of water heater (217)m	88.4545	88.4990	88.5553	88.8182	88.6989	79.9000	79.9000	79.9000	79.9000	87.1888	88.0233	79.9000 (216)
Fuel for water heating, kWh/month	197.7313	154.1694	124.8337	64.1124	32.5239	0.7986	0.0000	33.8833	74.2305	128.9777	169.8781	199.2915 (219)
Water heating fuel used												1180.4306 (219)
Annual totals kWh/year												
Space heating fuel - main system												4453.6949 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 12.2330, total flow = 53.0000, SFP = 0.2308)												
mechanical ventilation fans (SFP = 0.2308)												97.8330 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												222.8330 (231)
Electricity for lighting (calculated in Appendix L)												496.2015 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1179 * 1.00) =										-933.8290		-933.8290 (233)
Total delivered energy for all uses												5419.3310 (238)

10a. Fuel costs - using BEDF prices (535)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4453.6949	7.6100	338.9262 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1180.4306	7.6100	89.8308 (247)
Mechanical ventilation fans	97.8330	31.0800	30.4065 (249)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Pump for solar water heating	50.0000	31.0800	15.5400 (249)
Energy for lighting	496.2015	31.0800	154.2194 (250)
Additional standing charges			105.0000 (251)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-933.8290	31.0800	-290.2340 (252)
Total energy cost			466.9988 (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	4453.6949	0.2160	961.9981 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1180.4306	0.2160	254.9730 (264)
Space and water heating			1216.9711 (265)
Pumps and fans	222.8330	0.5190	115.6503 (267)
Energy for lighting	496.2015	0.5190	257.5286 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	0.5190	-484.6572 (269)
Total kg/year			1105.4928 (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	4453.6949	1.2200	5433.5077 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1180.4306	1.2200	1440.1254 (264)
Space and water heating			6873.6331 (265)
Pumps and fans	222.8330	3.0700	684.0972 (267)
Energy for lighting	496.2015	3.0700	1523.3385 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	3.0700	-2866.8549 (269)
Primary energy kWh/year			6214.2140 (272)
Primary energy kWh/m2/year			45.3394 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	3
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	87.9 (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	458.61 (P1)
Transmission heat loss coefficient	112.05 (37)
Summer heat loss coefficient	570.66 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)
West	1.000	1.00	1.000	1.000 (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	8.2400	81.1852	0.7200	0.7000	0.9000	273.0986
East	4.2500	117.5071	0.7200	0.7000	0.9000	203.8771
South	4.1300	112.2060	0.7200	0.7000	0.9000	189.1828
West	0.6000	117.5071	0.7200	0.7000	0.9000	28.7827
South	4.5200	112.2060	0.7200	0.7000	0.9000	207.0475
West	1.4600	203.0000	0.6300	0.7000	1.0000	117.6332

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

total:				1019.6220
	Jun	Jul	Aug	
Solar gains	1079	1020	918	(P3)
Internal gains	601	578	587	
Total summer gains	1680	1597	1505	(P5)
Summer gain/loss ratio	2.94	2.80	2.64	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 87.9)	1.38	1.38	1.38	
Threshold temperature	20.33	22.08	21.82	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			