

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-152				Issued on Date	11/11/2022
Assessment Reference	As Built	Prop Type Ref	G Det As			
Property	3, Keepers Drive, Fair Oak, EASTLEIGH, SO50 7QR					
SAP Rating	88 B	DER	12.61	TER	16.57	
Environmental	89 B	% DER<TER	23.88			
CO ₂ Emissions (t/year)	1.21	DFEE	46.46	TFEE	54.89	
General Requirements Compliance	Pass	% DFEE<TFEE	15.36			
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 122 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) 16.57 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 12.61 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.9 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)46.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	4.86 (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: 1.20 kWh/day	
Permitted by DBSCG 2.03	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 (Southern England): Slight OK

Based on:

Overshading:	Average
Windows facing North:	6.57 m ² , No overhang
Windows facing East:	1.21 m ² , No overhang
Windows facing South:	8.77 m ² , No overhang
Windows facing West:	1.21 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.11 W/m ² K
Photovoltaic array	0.90 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	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (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					4.8600
Infiltration rate					0.2430 (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)	=	0.2430 (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	0.3098	0.3038	0.2977	0.2673	0.2612	0.2309	0.2309	0.2248	0.2430	0.2612	0.2734	0.2855 (22b)
Mechanical extract ventilation - decentralised												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5598	0.5538	0.5477	0.5173	0.5112	0.5000	0.5000	0.5000	0.5000	0.5112	0.5234	0.5355 (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)			13.2500	1.3258	17.5663		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			61.2000	0.1800	11.0160	75.0000	4590.0000 (28a)
140mm Timber Frame	160.7800	19.8800	140.9000	0.1900	26.7710	9.0000	1268.1000 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Total net area of external elements Aum(A, m ²)			283.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8205		(33)
Timber GF			92.1100			9.0000	828.9900 (32c)
Timber FF			131.3300			9.0000	1181.9700 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10623.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							86.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0436 (36)
Total fabric heat loss						(33) + (36) =	85.8641 (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	57.4356	56.8124	56.1891	53.0727	52.4495	51.2978	51.2978	51.2978	51.2978	52.4495	53.6960	54.9426 (38)
Average = Sum(39)m / 12 =	143.2997	142.6765	142.0532	138.9368	138.3136	137.1619	137.1619	137.1619	137.1619	138.3136	139.5601	140.8066 (39)
												139.3840 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1707	1.1657	1.1606	1.1351	1.1300	1.1206	1.1206	1.1206	1.1206	1.1300	1.1402	1.1504 (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												2.8721 (42)
Average daily hot water use (litres/day)												102.4131 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy content (annual)	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1611.3564 (45)
	25.0595	21.9172	22.6166	19.7177	18.9196	16.3262	15.1286	17.3603	17.5676	20.4734	22.3483	24.2688 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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												
	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (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												
	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (64)
Total per year (kWh/year) = Sum(64)m =												2121.7724 (64)
Heat gains from water heating, kWh/month												
	90.2288	79.9072	84.8137	77.2691	76.6187	69.7512	68.2153	73.1622	72.5031	80.0629	83.1003	88.4761 (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	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	27.3621	24.3028	19.7644	14.9629	11.1849	9.4428	10.2033	13.2626	17.8010	22.6025	26.3805	28.1226 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	288.3055	291.2973	283.7582	267.7086	247.4488	228.4074	215.6866	212.6949	220.2339	236.2836	256.5434	275.5847 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606 (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)												
	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852 (71)
Water heating gains (Table 5)												
	121.2753	118.9096	113.9969	107.3182	102.9821	96.8767	91.6873	98.3364	100.6988	107.6114	115.4170	118.9195 (72)
Total internal gains												
	506.0249	503.5916	486.6015	459.0716	430.6978	403.8089	386.6591	393.3758	407.8157	435.5794	467.4228	491.7088 (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					6.5700	10.6334	0.7200	0.7000	0.7700	24.4006 (74)		
East					1.2100	19.6403	0.7200	0.7000	0.7700	8.3004 (76)		
South					4.2600	46.7521	0.7200	0.7000	0.7700	69.5623 (78)		
West					1.2100	19.6403	0.7200	0.7000	0.7700	8.3004 (80)		
South					4.5100	46.7521	0.7200	0.7000	0.7700	73.6446 (78)		

Solar gains	184.2083	313.6415	431.4755	542.9347	618.9051	620.0181	595.3753	537.2813	469.5566	347.0109	220.5495	157.7372 (83)
Total gains	690.2332	817.2330	918.0769	1002.0063	1049.6029	1023.8270	982.0344	930.6571	877.3723	782.5903	687.9723	649.4459 (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	20.5922	20.6821	20.7729	21.2388	21.3345	21.5136	21.5136	21.5136	21.5136	21.3345	21.1439	20.9568
alpha	2.3728	2.3788	2.3849	2.4159	2.4223	2.4342	2.4342	2.4342	2.4342	2.4223	2.4096	2.3971
util living area	0.9622	0.9431	0.9137	0.8605	0.7758	0.6526	0.5254	0.5629	0.7351	0.8808	0.9453	0.9669 (86)
MIT	18.2798	18.5940	19.0718	19.6941	20.2458	20.6637	20.8596	20.8283	20.5167	19.8031	18.9477	18.2452 (87)
Th 2	19.9435	19.9476	19.9517	19.9723	19.9764	19.9840	19.9840	19.9840	19.9840	19.9764	19.9681	19.9599 (88)
util rest of house	0.9569	0.9353	0.9013	0.8390	0.7378	0.5867	0.4291	0.4689	0.6787	0.8582	0.9365	0.9622 (89)
MIT 2	16.2997	16.7555	17.4456	18.3429	19.1099	19.6605	19.8836	19.8544	19.4871	18.5132	17.2838	16.2581 (90)
Living area fraction									fLA = Living area / (4) =			0.1391 (91)
MIT	16.5751	17.0111	17.6717	18.5308	19.2678	19.8000	20.0194	19.9898	19.6302	18.6926	17.5151	16.5344 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.4251	16.8611	17.5217	18.3808	19.1178	19.6500	19.8694	19.8398	19.4802	18.5426	17.3651	16.3844 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	641.5329	736.6455	790.8709	798.0515	734.4095	575.5017	409.6547	422.5150	566.2094	638.4472	621.4515	608.6173 (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												
	1737.5180	1706.5731	1565.6698	1317.2362	1025.9861	692.6646	448.4304	471.8106	737.9649	1098.5657	1432.6047	1715.6505 (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)

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Space heating kWh	815.4130	651.7914	576.4504	373.8130	216.9330	0.0000	0.0000	0.0000	0.0000	342.3281	584.0303	823.6327 (98)
Space heating												4384.3918 (98)
Space heating per m2												(98) / (4) = 35.8202 (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												4839.2845 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	815.4130	651.7914	576.4504	373.8130	216.9330	0.0000	0.0000	0.0000	0.0000	342.3281	584.0303	823.6327 (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)	900.0143	719.4165	636.2587	412.5971	239.4403	0.0000	0.0000	0.0000	0.0000	377.8456	644.6251	909.0869 (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	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (64)
Efficiency of water heater (217)m	88.1779	87.9919	87.6432	86.9118	85.5737	79.9000	79.9000	79.9000	79.9000	86.6055	87.7061	79.9000 (216)
Fuel for water heating, kWh/month	238.6240	210.5532	221.4976	199.5162	198.0525	188.7272	180.4851	199.1058	199.0856	207.6535	217.7048	232.4727 (219)
Water heating fuel used												2493.4781 (219)
Annual totals kWh/year												
Space heating fuel - main system												4839.2845 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.0221 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.0221 (231)
Electricity for lighting (calculated in Appendix L)												483.2236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.90 * 1004 * 1.00) =										-722.8773		-722.8773 (233)
Total delivered energy for all uses												7255.1311 (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	4839.2845	0.2160	1045.2855 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2493.4781	0.2160	538.5913 (264)
Space and water heating			1583.8767 (265)
Pumps and fans	162.0221	0.5190	84.0895 (267)
Energy for lighting	483.2236	0.5190	250.7931 (268)
Energy saving/generation technologies			
PV Unit	-722.8773	0.5190	-375.1733 (269)
Total CO2, kg/year			1543.5860 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6100 (273)

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

DER			12.6100 ZC1
Total Floor Area		TFA	122.4000
Assumed number of occupants		N	2.8721
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.9578 ZC2
CO2 emissions from cooking, equation (L16)			1.5354 ZC3
Total CO2 emissions			28.1032 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			28.1032 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (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) =					40.0000	/ (5) =	0.1287 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3787 (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) =					0.3787	(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	0.4828	0.4733	0.4639	0.4165	0.4071	0.3597	0.3597	0.3503	0.3787	0.4071	0.4260	0.4449	(22b)				
Effective ac	0.6165	0.6120	0.6076	0.5867	0.5828	0.5647	0.5647	0.5613	0.5717	0.5828	0.5907	0.5990	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			17.7600	1.3258	23.5455		(27)					
150mm EPS B&B			61.2000	0.1300	7.9560		(28a)					
140mm Timber Frame	160.7800	19.8800	140.9000	0.1800	25.3620		(29a)					
400mm Mineral Wool	61.2000		61.2000	0.1300	7.9560		(30)					
Total net area of external elements Aum(A, m2)			283.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	66.9395		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6268 (36)					
Total fabric heat loss						(33) + (36) =	78.5663 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 63.2548	Feb 62.7905	Mar 62.3353	Apr 60.1977	May 59.7978	Jun 57.9360	Jul 57.9360	Aug 57.5912	Sep 58.6531	Oct 59.7978	Nov 60.6069	Dec 61.4527 (38)
Heat transfer coeff	141.8210	141.3567	140.9016	138.7640	138.3640	136.5022	136.5022	136.1575	137.2194	138.3640	139.1731	140.0190 (39)
Average = Sum(39)m / 12 =												138.7621 (39)
HLP	Jan 1.1587	Feb 1.1549	Mar 1.1512	Apr 1.1337	May 1.1304	Jun 1.1152	Jul 1.1152	Aug 1.1124	Sep 1.1211	Oct 1.1304	Nov 1.1370	Dec 1.1439 (40)
HLP (average)												1.1337 (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												2.8721 (42)
Average daily hot water use (litres/day)												102.4131 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy content (annual)	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Distribution loss	Total = Sum(45)m =											1611.3564 (45)
(46)m = 0.15 x (45)m												
25.0595	21.9172	22.6166	19.7177	18.9196	16.3262	15.1286	17.3603	17.5676	20.4734	22.3483	24.2688 (46)	
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5003 (48)
Temperature factor from Table 2b												0.5400 (49)

Enter (49) or (54) in (55)												0.8102 (55)
Total storage loss	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (56)
If cylinder contains dedicated solar storage	25.1153	22.6848	25.1153	24.3051	25.1153	24.3051	25.1153	25.1153	24.3051	25.1153	24.3051	25.1153 (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	215.4409	189.8105	199.1548	178.2683	174.5082	155.6582	149.2349	164.1128	163.9345	184.8667	195.8056	210.1695 (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	215.4409	189.8105	199.1548	178.2683	174.5082	155.6582	149.2349	164.1128	163.9345	184.8667	195.8056	210.1695 (64)
								Total per year (kWh/year) =	Sum (64)m =			2180.9649 (64)
Heat gains from water heating, kWh/month	94.2507	83.5399	88.8356	81.1612	80.6406	73.6433	72.2372	77.1841	76.3952	84.0848	86.9924	92.4979 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.3621	24.3028	19.7644	14.9629	11.1849	9.4428	10.2033	13.2626	17.8010	22.6025	26.3805	28.1226 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.3055	291.2973	283.7582	267.7086	247.4488	228.4074	215.6866	212.6949	220.2339	236.2836	256.5434	275.5847 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606 (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)	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852 (71)
Water heating gains (Table 5)	126.6810	124.3153	119.4026	112.7239	108.3878	102.2824	97.0930	103.7421	106.1045	113.0171	120.8227	124.3252 (72)
Total internal gains	511.4306	508.9973	492.0072	464.4773	436.1035	409.2146	392.0648	398.7815	413.2214	440.9851	472.8285	497.1145 (73)

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				6.5700	10.6334	0.6300	0.7000	0.7700	21.3505 (74)			
East				1.2100	19.6403	0.6300	0.7000	0.7700	7.2628 (76)			
South				8.7700	46.7521	0.6300	0.7000	0.7700	125.3061 (78)			
West				1.2100	19.6403	0.6300	0.7000	0.7700	7.2628 (80)			
Solar gains	161.1823	274.4363	377.5410	475.0678	541.5420	542.5159	520.9534	470.1211	410.8621	303.6345	192.9808	138.0200 (83)
Total gains	672.6129	783.4336	869.5482	939.5451	977.6454	951.7304	913.0182	868.9026	824.0834	744.6197	665.8093	635.1345 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.9347	60.1316	60.3258	61.2551	61.4321	62.2700	62.2700	62.4277	61.9446	61.4321	61.0750	60.7061
alpha	4.9956	5.0088	5.0217	5.0837	5.0955	5.1513	5.1513	5.1618	5.1296	5.0955	5.0717	5.0471
util living area	0.9987	0.9969	0.9921	0.9763	0.9271	0.7996	0.6297	0.6780	0.8890	0.9829	0.9971	0.9990 (86)
MIT	19.7002	19.8540	20.0945	20.4138	20.7071	20.9130	20.9801	20.9712	20.8348	20.4555	20.0227	19.6805 (87)
Th 2	19.9532	19.9563	19.9593	19.9734	19.9761	19.9884	19.9884	19.9907	19.9837	19.9761	19.9707	19.9651 (88)
util rest of house	0.9982	0.9958	0.9891	0.9664	0.8944	0.7143	0.4990	0.5496	0.8282	0.9739	0.9958	0.9987 (89)
MIT 2	18.2157	18.4425	18.7949	19.2649	19.6707	19.9254	19.9805	19.9779	19.8426	19.3308	18.6998	18.1953 (90)
Living area fraction										fLA = Living area / (4) =		0.1391 (91)
MIT	18.4221	18.6388	18.9756	19.4247	19.8148	20.0627	20.1195	20.1160	19.9805	19.4872	18.8838	18.4018 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4221	18.6388	18.9756	19.4247	19.8148	20.0627	20.1195	20.1160	19.9805	19.4872	18.8838	18.4018 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9971	0.9937	0.9850	0.9593	0.8880	0.7214	0.5169	0.5668	0.8279	0.9679	0.9938	0.9979 (94)
Useful gains	670.6926	778.4588	856.5427	901.3459	868.1139	686.5597	471.9287	492.5231	682.2817	720.6995	661.7029	633.7713 (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												
	2002.8123	1942.0685	1757.8283	1460.4447	1122.7995	745.6758	480.4244	505.9669	806.9244	1229.6731	1639.9826	1988.5207 (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												
	991.0970	781.9458	670.5565	402.5511	189.4861	0.0000	0.0000	0.0000	0.0000	378.6764	704.3614	1007.9335 (98)
Space heating												
												5126.6078 (98)
Space heating per m2												
										(98) / (4) =		41.8841 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													93.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5483.0030	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	991.0970	781.9458	670.5565	402.5511	189.4861	0.0000	0.0000	0.0000	0.0000	378.6764	704.3614	1007.9335	(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)	1059.9968	836.3056	717.1727	430.5360	202.6589	0.0000	0.0000	0.0000	0.0000	405.0015	753.3277	1078.0038	(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	215.4409	189.8105	199.1548	178.2683	174.5082	155.6582	149.2349	164.1128	163.9345	184.8667	195.8056	210.1695	(64)	
Efficiency of water heater (217)m	88.3839	88.1903	87.8041	86.9228	85.0337	79.8000	79.8000	79.8000	79.8000	86.6870	87.9352	88.4536	(216)	
Fuel for water heating, kWh/month	243.7559	215.2285	226.8173	205.0881	205.2224	195.0604	187.0112	205.6552	205.4317	213.2577	222.6702	237.6041	(219)	
Water heating fuel used												2562.8026	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5483.0030	(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)												483.2236	(232)	
Total delivered energy for all uses												8604.0292	(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	5483.0030	0.2160	1184.3287 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2562.8026	0.2160	553.5654 (264)
Space and water heating			1737.8940 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	483.2236	0.5190	250.7931 (268)
Total CO2, kg/m2/year			2027.6121 (272)
Emissions per m2 for space and water heating			14.1985 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0490 (272b)
Emissions per m2 for pumps and fans			0.3180 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1985 * 1.00) + 2.0490 + 0.3180, rounded to 2 d.p.			16.5700 (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	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (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) = 0.1287 (8)
Pressure test					Yes
Measured/design AP50					4.8600
Infiltration rate					0.3717 (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) =	0.3717 (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	0.4739	0.4646	0.4553	0.4088	0.3995	0.3531	0.3531	0.3438	0.3717	0.3995	0.4181	0.4367 (22b)
Effective ac	0.6123	0.6079	0.6036	0.5836	0.5798	0.5623	0.5623	0.5591	0.5691	0.5798	0.5874	0.5954 (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)			13.2500	1.3258	17.5663		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			61.2000	0.1800	11.0160	75.0000	4590.0000 (28a)
140mm Timber Frame	160.7800	19.8800	140.9000	0.1900	26.7710	9.0000	1268.1000 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Total net area of external elements Aum (m ²)			283.1800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.8205		(33)
Timber GF			92.1100			9.0000	828.9900 (32c)
Timber FF			131.3300			9.0000	1181.9700 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			9.0000	550.8000 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 10072.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 82.2897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 15.0436 (36)
Total fabric heat loss (33) + (36) = 85.8641 (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	62.8168	62.3695	61.9310	59.8717	59.4864	57.6928	57.6928	57.3607	58.3837	59.4864	60.2659	61.0807 (38)
Heat transfer coeff	148.6809	148.2336	147.7951	145.7358	145.3505	143.5569	143.5569	143.2248	144.2478	145.3505	146.1300	146.9448 (39)
Average = Sum(39)m / 12 =												145.7340 (39)
HLP	1.2147	1.2111	1.2075	1.1907	1.1875	1.1729	1.1729	1.1701	1.1785	1.1875	1.1939	1.2005 (40)
HLP (average)												1.1906 (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												2.8721 (42)
Average daily hot water use (litres/day)												102.4131 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy conte	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Energy content (annual)										Total = Sum(45)m =		1611.3564 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.5009	31.0493	32.0401	27.9334	26.8027	23.1287	21.4322	24.5937	24.8874	29.0039	31.6600	34.3808 (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	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.3621	24.3028	19.7644	14.9629	11.1849	9.4428	10.2033	13.2626	17.8010	22.6025	26.3805	28.1226	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.3055	291.2973	283.7582	267.7086	247.4488	228.4074	215.6866	212.6949	220.2339	236.2836	256.5434	275.5847	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	(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)	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	(71)
Water heating gains (Table 5)	47.7163	46.2044	43.0647	38.7963	36.0252	32.1232	28.8067	33.0561	34.5659	38.9838	43.9723	46.2107	(72)
Total internal gains	429.4659	427.8864	412.6692	387.5498	360.7408	336.0554	320.7785	325.0955	338.6828	363.9518	392.9781	416.0000	(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				6.5700	10.6334		0.7200		0.7000		0.7700		24.4006 (74)
East				1.2100	19.6403		0.7200		0.7000		0.7700		8.3004 (76)
South				4.2600	46.7521		0.7200		0.7000		0.7700		69.5623 (78)
West				1.2100	19.6403		0.7200		0.7000		0.7700		8.3004 (80)
South				4.5100	46.7521		0.7200		0.7000		0.7700		73.6446 (78)
Solar gains	184.2083	313.6415	431.4755	542.9347	618.9051	620.0181	595.3753	537.2813	469.5566	347.0109	220.5495	157.7372	(83)
Total gains	613.6742	741.5278	844.1447	930.4844	979.6459	956.0735	916.1537	862.3768	808.2394	710.9626	613.5276	573.7372	(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	18.8178	18.8746	18.9306	19.1981	19.2490	19.4895	19.4895	19.5347	19.3961	19.2490	19.1463	19.0401	
alpha	2.2545	2.2583	2.2620	2.2799	2.2833	2.2993	2.2993	2.3023	2.2931	2.2833	2.2764	2.2693	
util living area	0.9674	0.9497	0.9226	0.8746	0.7977	0.6829	0.5606	0.5992	0.7650	0.8967	0.9533	0.9718	(86)
MIT	17.9891	18.3152	18.8200	19.4728	20.0818	20.5695	20.8089	20.7697	20.3908	19.5924	18.6768	17.9379	(87)
Th 2	19.9082	19.9112	19.9140	19.9275	19.9300	19.9418	19.9418	19.9440	19.9372	19.9300	19.9249	19.9196	(88)
util rest of house	0.9628	0.9427	0.9113	0.8547	0.7614	0.6171	0.4597	0.5021	0.7105	0.8763	0.9457	0.9678	(89)
MIT 2	17.1516	17.4756	17.9752	18.6218	19.2049	19.6555	19.8470	19.8231	19.5045	18.7495	17.8464	17.1082	(90)
Living area fraction	17.2680	17.5924	18.0926	18.7401	19.3268	19.7826	19.9807	19.9547	19.6278	18.8667	17.9619	17.2235	(92)
Temperature adjustment	17.2680	17.5924	18.0926	18.7401	19.3268	19.7826	19.9807	19.9547	19.6278	18.8667	17.9619	17.2235	(93)
adjusted MIT	17.2680	17.5924	18.0926	18.7401	19.3268	19.7826	19.9807	19.9547	19.6278	18.8667	17.9619	17.2235	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	581.2248	683.8831	748.2655	769.6960	722.1524	579.2748	424.9481	433.9478	558.9826	604.3313	568.2775	547.1160	(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	1928.0978	1881.4341	1713.3363	1434.0604	1108.5638	743.9932	485.3246	509.1195	797.3707	1201.5682	1587.2496	1913.7415	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1002.0735	804.7543	718.0126	478.3424	287.4901	0.0000	0.0000	0.0000	0.0000	444.3443	733.6599	1016.7694	(98)
Space heating												5485.4465	(98)
Space heating per m2												44.8157	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1349.4349	1062.3211	1088.5082	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6652	0.7339	0.7083	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	897.5844	779.6495	771.0443	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1233.8808	1184.6758	1124.2062	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	242.1334	301.3396	262.7525	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			806.2254 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	60.5333	75.3349	65.6881	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												201.5564 (107)
Energy for space heating												1.6467 (108)
Energy for space cooling												44.8157 (99)
Total												1.6467 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.4624 (109)
												46.5 (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	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1287 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3787 (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) =	0.3787 (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	0.4828	0.4733	0.4639	0.4165	0.4071	0.3597	0.3597	0.3503	0.3787	0.4071	0.4260	0.4449 (22b)
Effective ac	0.6165	0.6120	0.6076	0.5867	0.5828	0.5647	0.5647	0.5613	0.5717	0.5828	0.5907	0.5990 (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)			17.7600	1.3258	23.5455		(27)
150mm EPS B&B			61.2000	0.1300	7.9560		(28a)
140mm Timber Frame	160.7800	19.8800	140.9000	0.1800	25.3620		(29a)
400mm Mineral Wool	61.2000		61.2000	0.1300	7.9560		(30)
Total net area of external elements Aum(A, m ²)			283.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.9395		(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)							11.6268 (36)
Total fabric heat loss						(33) + (36) =	78.5663 (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	63.2548	62.7905	62.3353	60.1977	59.7978	57.9360	57.9360	57.5912	58.6531	59.7978	60.6069	61.4527 (38)
Heat transfer coeff	141.8210	141.3567	140.9016	138.7640	138.3640	136.5022	136.5022	136.1575	137.2194	138.3640	139.1731	140.0190 (39)
Average = Sum(39)m / 12 =												138.7621 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1587	1.1549	1.1512	1.1337	1.1304	1.1152	1.1152	1.1124	1.1211	1.1304	1.1370	1.1439 (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												2.8721 (42)
Average daily hot water use (litres/day)												102.4131 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy conte	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Energy content (annual)										Total = Sum(45)m =		1611.3564 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.5009	31.0493	32.0401	27.9334	26.8027	23.1287	21.4322	24.5937	24.8874	29.0039	31.6600	34.3808 (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	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	143.6065	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.3621	24.3028	19.7644	14.9629	11.1849	9.4428	10.2033	13.2626	17.8010	22.6025	26.3805	28.1226	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.3055	291.2973	283.7582	267.7086	247.4488	228.4074	215.6866	212.6949	220.2339	236.2836	256.5434	275.5847	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	37.3606	(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)	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	(71)
Water heating gains (Table 5)	47.7163	46.2044	43.0647	38.7963	36.0252	32.1232	28.8067	33.0561	34.5659	38.9838	43.9723	46.2107	(72)
Total internal gains	429.4659	427.8864	412.6692	387.5498	360.7408	336.0554	320.7785	325.0955	338.6828	363.9518	392.9781	416.0000	(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	6.5700	10.6334	0.6300	0.7000	0.7700	21.3505 (74)
East	1.2100	19.6403	0.6300	0.7000	0.7700	7.2628 (76)
South	8.7700	46.7521	0.6300	0.7000	0.7700	125.3061 (78)
West	1.2100	19.6403	0.6300	0.7000	0.7700	7.2628 (80)

Solar gains	161.1823	274.4363	377.5410	475.0678	541.5420	542.5159	520.9534	470.1211	410.8621	303.6345	192.9808	138.0200	(83)
Total gains	590.6482	702.3226	790.2103	862.6176	902.2828	878.5712	841.7318	795.2166	749.5448	667.5863	585.9589	554.0200	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.9347	60.1316	60.3258	61.2551	61.4321	62.2700	62.2700	62.4277	61.9446	61.4321	61.0750	60.7061	
alpha	4.9956	5.0088	5.0217	5.0837	5.0955	5.1513	5.1513	5.1618	5.1296	5.0955	5.0717	5.0471	
util living area	0.9993	0.9981	0.9948	0.9832	0.9447	0.8351	0.6725	0.7243	0.9174	0.9892	0.9984	0.9995	(86)
MIT	19.6378	19.7927	20.0357	20.3606	20.6655	20.8919	20.9733	20.9611	20.8001	20.4004	19.9621	19.6184	(87)
Th 2	19.9532	19.9563	19.9593	19.9734	19.9761	19.9884	19.9884	19.9907	19.9837	19.9761	19.9707	19.9651	(88)
util rest of house	0.9990	0.9974	0.9928	0.9760	0.9178	0.7551	0.5379	0.5946	0.8663	0.9833	0.9977	0.9993	(89)
MIT 2	18.7046	18.8617	19.1063	19.4388	19.7320	19.9327	19.9809	19.9783	19.8618	19.4826	19.0427	18.6948	(90)
Living area fraction									fLA = Living area / (4) =			0.1391	(91)
MIT	18.8343	18.9912	19.2355	19.5670	19.8618	20.0661	20.1189	20.1150	19.9922	19.6102	19.1705	18.8232	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8343	18.9912	19.2355	19.5670	19.8618	20.0661	20.1189	20.1150	19.9922	19.6102	19.1705	18.8232	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9986	0.9965	0.9908	0.9721	0.9141	0.7622	0.5566	0.6122	0.8668	0.9803	0.9969	0.9990	(94)
Ext temp.	589.8292	699.8626	782.9645	838.5936	824.7333	669.6764	468.4947	486.8363	649.7303	654.4306	584.1289	553.4687	(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	2061.2758	1991.8799	1794.4556	1480.1914	1129.2976	746.1375	480.3342	505.8182	808.5297	1246.6861	1679.8896	2047.5277	(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	1094.7563	868.2356	752.5494	461.9504	226.5958	0.0000	0.0000	0.0000	0.0000	440.6381	788.9477	1111.5799	(98)
Space heating per m2												5745.2532	(98)
												(98) / (4) =	46.9383 (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	1283.1210	1010.1165	1034.7966	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7856	0.8702	0.8421	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1007.9976	878.9562	871.3734	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1143.2937	1097.6891	1045.7073	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	97.4132	162.7373	129.7045	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												389.8550 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	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	24.3533	40.6843	32.4261	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												97.4637 (107)
Space cooling per m2												0.7963 (108)
Energy for space heating												46.9383 (99)
Energy for space cooling												0.7963 (108)
Total												47.7346 (109)
Target Fabric Energy Efficiency (TFEE)												54.9 (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	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (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												4.8600
Infiltration rate												0.2430 (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) =	0.2430 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.2673	0.2491	0.2491	0.2369	0.2369	0.2248	0.2248	0.2126	0.2126	0.2309	0.2248	0.2369 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5173	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 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)			13.2500	1.3258	17.5663		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			61.2000	0.1800	11.0160	75.0000	4590.0000 (28a)
140mm Timber Frame	160.7800	19.8800	140.9000	0.1900	26.7710	9.0000	1268.1000 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Total net area of external elements Aum(A, m ²)			283.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8205		(33)
Timber GF			92.1100			9.0000	828.9900 (32c)
Timber FF			131.3300			9.0000	1181.9700 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10623.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							86.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0436 (36)
Total fabric heat loss						(33) + (36) =	85.8641 (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	53.0727	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978 (38)
Heat transfer coeff	138.9368	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619 (39)
Average = Sum(39)m / 12 =												137.3098 (39)
HLP	1.1351	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206 (40)
HLP (average)												1.1218 (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	2.8721 (42)
Average daily hot water use (litres/day)	102.4131 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy content (annual)	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1611.3564 (45)
	25.0595	21.9172	22.6166	19.7177	18.9196	16.3262	15.1286	17.3603	17.5676	20.4734	22.3483	24.2688 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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												
	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (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												
	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (64)
								Total per year (kWh/year) = Sum (64)m =				2121.7724 (64)
RHI water heating demand												2122 (64)
Heat gains from water heating, kWh/month												
	90.2288	79.9072	84.8137	77.2691	76.6187	69.7512	68.2153	73.1622	72.5031	80.0629	83.1003	88.4761 (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	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	68.4053	60.7570	49.4109	37.4072	27.9623	23.6070	25.5082	33.1565	44.5026	56.5063	65.9511	70.3065 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	430.3068	434.7720	423.5198	399.5651	369.3265	340.9066	321.9203	317.4550	328.7073	352.6620	382.9006	411.3205 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049 (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)												
	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852 (71)
Water heating gains (Table 5)												
	121.2753	118.9096	113.9969	107.3182	102.9821	96.8767	91.6873	98.3364	100.6988	107.6114	115.4170	118.9195 (72)
Total internal gains												
	735.5349	729.9861	702.4751	659.8380	615.8185	576.9378	554.6633	564.4954	589.4562	632.3272	679.8162	716.0940 (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				6.5700	13.4839		0.7200		0.7000		0.7700		30.9417 (74)
East				1.2100	25.1925		0.7200		0.7000		0.7700		10.6468 (76)
South				4.2600	56.7559		0.7200		0.7000		0.7700		84.4470 (78)
West				1.2100	25.1925		0.7200		0.7000		0.7700		10.6468 (80)
South				4.5100	56.7559		0.7200		0.7000		0.7700		89.4028 (78)
Solar gains	226.0852	327.8194	456.3935	582.5218	632.6133	697.0630	644.9010	603.6917	522.1900	386.7423	269.8143	183.2748	(83)
Total gains	961.6201	1057.8055	1158.8686	1242.3598	1248.4318	1274.0008	1199.5643	1168.1871	1111.6462	1019.0695	949.6305	899.3687	(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	21.2388	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136
alpha	2.4159	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342
util living area	0.9167	0.8941	0.8487	0.7740	0.6571	0.4831	0.3546	0.3629	0.5770	0.7732	0.8797	0.9250 (86)
MIT	18.9496	19.1957	19.6301	20.1226	20.5780	20.8653	20.9563	20.9540	20.7749	20.2841	19.5685	18.9251 (87)
Th 2	19.9723	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840 (88)
util rest of house	0.9057	0.8805	0.8286	0.7425	0.6049	0.4043	0.2537	0.2601	0.5022	0.7339	0.8614	0.9149 (89)
MIT 2	17.2778	17.6346	18.2502	18.9343	19.5401	19.8780	19.9631	19.9619	19.7863	19.1686	18.1738	17.2510 (90)
Living area fraction									fLA = Living area / (4) =			0.1391 (91)
MIT	17.5103	17.8517	18.4420	19.0995	19.6845	20.0153	20.1012	20.0999	19.9238	19.3237	18.3677	17.4838 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3603	17.7017	18.2920	18.9495	19.5345	19.8653	19.9512	19.9499	19.7738	19.1737	18.2177	17.3338 (93)

8. Space heating requirement

Utilisation	0.8671	0.8398	0.7867	0.7045	0.5790	0.3943	0.2503	0.2565	0.4851	0.6963	0.8197	0.8780 (94)
Useful gains	833.8276	888.3761	911.7104	875.3013	722.8306	502.4012	300.2761	299.6161	539.2523	709.5641	778.4025	789.6450 (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	1661.7258	1618.7443	1466.5402	1227.5318	882.5638	543.8853	308.7849	308.5988	613.6335	983.9543	1346.6151	1623.1412 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	615.9563	490.8074	412.7934	253.6059	118.8416	0.0000	0.0000	0.0000	0.0000	204.1463	409.1131	620.1211	(98)
Space heating												3125.3851	(98)
RHI space heating demand												3125	(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	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (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															4.8600		
Infiltration rate															0.2430 (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) =					0.2430 (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																	
	0.3098	0.3038	0.2977	0.2673	0.2612	0.2309	0.2309	0.2248	0.2430	0.2612	0.2734	0.2855 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5598	0.5538	0.5477	0.5173	0.5112	0.5000	0.5000	0.5000	0.5000	0.5112	0.5234	0.5355 (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)			13.2500	1.3258	17.5663		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			61.2000	0.1800	11.0160	75.0000	4590.0000 (28a)
140mm Timber Frame	160.7800	19.8800	140.9000	0.1900	26.7710	9.0000	1268.1000 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Total net area of external elements Aum(A, m ²)			283.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8205		(33)
Timber GF			92.1100			9.0000	828.9900 (32c)
Timber FF			131.3300			9.0000	1181.9700 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10623.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							86.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0436 (36)
Total fabric heat loss						(33) + (36) =	85.8641 (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	57.4356	56.8124	56.1891	53.0727	52.4495	51.2978	51.2978	51.2978	51.2978	52.4495	53.6960	54.9426 (38)
Heat transfer coeff	143.2997	142.6765	142.0532	138.9368	138.3136	137.1619	137.1619	137.1619	137.1619	138.3136	139.5601	140.8066 (39)
Average = Sum(39)m / 12 =												139.3840 (39)
HLP	1.1707	1.1657	1.1606	1.1351	1.1300	1.1206	1.1206	1.1206	1.1206	1.1300	1.1402	1.1504 (40)
HLP (average)												1.1388 (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	2.8721 (42)
Average daily hot water use (litres/day)	102.4131 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy content (annual)	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1611.3564 (45)
	25.0595	21.9172	22.6166	19.7177	18.9196	16.3262	15.1286	17.3603	17.5676	20.4734	22.3483	24.2688 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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												
	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (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												
	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (64)
Heat gains from water heating, kWh/month												
	90.2288	79.9072	84.8137	77.2691	76.6187	69.7512	68.2153	73.1622	72.5031	80.0629	83.1003	88.4761 (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	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	68.4053	60.7570	49.4109	37.4072	27.9623	23.6070	25.5082	33.1565	44.5026	56.5063	65.9511	70.3065 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	430.3068	434.7720	423.5198	399.5651	369.3265	340.9066	321.9203	317.4550	328.7073	352.6620	382.9006	411.3205 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049 (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)												
	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852 (71)
Water heating gains (Table 5)												
	121.2753	118.9096	113.9969	107.3182	102.9821	96.8767	91.6873	98.3364	100.6988	107.6114	115.4170	118.9195 (72)
Total internal gains												
	735.5349	729.9861	702.4751	659.8380	615.8185	576.9378	554.6633	564.4954	589.4562	632.3272	679.8162	716.0940 (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						6.5700	10.6334		0.7200	0.7000	0.7700	24.4006 (74)	
East						1.2100	19.6403		0.7200	0.7000	0.7700	8.3004 (76)	
South						4.2600	46.7521		0.7200	0.7000	0.7700	69.5623 (78)	
West						1.2100	19.6403		0.7200	0.7000	0.7700	8.3004 (80)	
South						4.5100	46.7521		0.7200	0.7000	0.7700	73.6446 (78)	

Solar gains	184.2083	313.6415	431.4755	542.9347	618.9051	620.0181	595.3753	537.2813	469.5566	347.0109	220.5495	157.7372	(83)
Total gains	919.7432	1043.6276	1133.9506	1202.7726	1234.7236	1196.9559	1150.0385	1101.7767	1059.0128	979.3381	900.3657	873.8312	(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	20.5922	20.6821	20.7729	21.2388	21.3345	21.5136	21.5136	21.5136	21.5136	21.3345	21.1439	20.9568
alpha	2.3728	2.3788	2.3849	2.4159	2.4223	2.4342	2.4342	2.4342	2.4342	2.4223	2.4096	2.3971
util living area	0.9337	0.9102	0.8752	0.8140	0.7221	0.5931	0.4665	0.4988	0.6680	0.8281	0.9091	0.9400 (86)
MIT	18.5860	18.8764	19.3143	19.8806	20.3695	20.7308	20.8926	20.8695	20.6168	19.9975	19.2153	18.5519 (87)
Th 2	19.9435	19.9476	19.9517	19.9723	19.9764	19.9840	19.9840	19.9840	19.9840	19.9764	19.9681	19.9599 (88)
util rest of house	0.9251	0.8988	0.8587	0.7883	0.6806	0.5269	0.3759	0.4092	0.6078	0.7992	0.8956	0.9322 (89)
MIT 2	16.7384	17.1563	17.7840	18.5938	19.2641	19.7308	19.9093	19.8884	19.6004	18.7732	17.6617	16.6986 (90)
Living area fraction									fLA = Living area / (4) =			0.1391 (91)
MIT	16.9953	17.3955	17.9968	18.7727	19.4178	19.8699	20.0460	20.0248	19.7417	18.9434	17.8777	16.9563 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8453	17.2455	17.8468	18.6227	19.2678	19.7199	19.8960	19.8748	19.5917	18.7934	17.7277	16.8063 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	817.4978	896.0003	925.1047	898.5649	799.3495	607.8756	422.6305	439.3464	615.6523	741.8126	770.3990	784.6587 (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												
	1797.7354	1761.4155	1611.8463	1350.8438	1046.7246	702.2486	452.0910	476.6135	753.2571	1133.2597	1483.2035	1775.0525 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	729.2968	581.5590	510.9357	325.6408	184.0471	0.0000	0.0000	0.0000	0.0000	291.2367	513.2193	736.8530 (98)
Space heating												3872.7884 (98)
Space heating per m2											(98) / (4) =	31.6404 (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												4274.6009 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	729.2968	581.5590	510.9357	325.6408	184.0471	0.0000	0.0000	0.0000	0.0000	291.2367	513.2193	736.8530 (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)	804.9634	641.8974	563.9467	359.4269	203.1425	0.0000	0.0000	0.0000	0.0000	321.4533	566.4672	813.3036 (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	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (64)
Efficiency of water heater	87.9624	87.7605	87.3782	86.5716	85.1344	79.9000	79.9000	79.9000	79.9000	86.1934	87.4253	79.9000 (216)
(217)m	87.9624	87.7605	87.3782	86.5716	85.1344	79.9000	79.9000	79.9000	79.9000	86.1934	87.4253	88.0326 (217)
Fuel for water heating, kWh/month	239.2086	211.1083	222.1693	200.3002	199.0746	188.7272	180.4851	199.1058	199.0856	208.6464	218.4040	233.0297 (219)
Water heating fuel used												2499.3449 (219)
Annual totals kWh/year												
Space heating fuel - main system												4274.6009 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.0221 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.0221 (231)
Electricity for lighting (calculated in Appendix L)												483.2236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.90 * 1004 * 1.00) =										-722.8773		-722.8773 (233)
Total delivered energy for all uses												6696.3143 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4274.6009	3.4800	148.7561 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2499.3449	3.4800	86.9772 (247)
Mechanical ventilation fans	87.0221	13.1900	11.4782 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	483.2236	13.1900	63.7372 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-722.8773	13.1900	-95.3475 (252)
Total energy cost			345.4937 (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] =	0.8668 (257)
SAP value		87.9077
SAP rating (Section 12)		88 (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	4274.6009	0.2160	923.3138 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2499.3449	0.2160	539.8585 (264)
Space and water heating			1463.1723 (265)
Pumps and fans	162.0221	0.5190	84.0895 (267)
Energy for lighting	483.2236	0.5190	250.7931 (268)
Energy saving/generation technologies			

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PV Unit	-722.8773	0.5190	-375.1733 (269)
Total kg/year			1422.8815 (272)
CO2 emissions per m2			11.6200 (273)
EI value			88.6101
EI rating			89 (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	$3.48 / 0.8467 = 4.110$, stars = 4
Water heating environmental impact	$0.216 / 0.8467 = 0.2551$, 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	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (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												4.8600
Infiltration rate												0.2430 (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) =	0.2430 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.2673	0.2491	0.2491	0.2369	0.2369	0.2248	0.2248	0.2126	0.2126	0.2309	0.2248	0.2369 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5173	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 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)			13.2500	1.3258	17.5663		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			61.2000	0.1800	11.0160	75.0000	4590.0000 (28a)
140mm Timber Frame	160.7800	19.8800	140.9000	0.1900	26.7710	9.0000	1268.1000 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Total net area of external elements Aum(A, m ²)			283.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8205		(33)
Timber GF			92.1100			9.0000	828.9900 (32c)
Timber FF			131.3300			9.0000	1181.9700 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10623.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							86.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0436 (36)
Total fabric heat loss						(33) + (36) =	85.8641 (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	53.0727	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978 (38)
Heat transfer coeff	138.9368	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619 (39)
Average = Sum(39)m / 12 =												137.3098 (39)
HLP	1.1351	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206 (40)
HLP (average)												1.1218 (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	2.8721 (42)
Average daily hot water use (litres/day)	102.4131 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Calculation Type: New Build (As Built)

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

Energy conte	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy content (annual)	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1611.3564 (45)
	25.0595	21.9172	22.6166	19.7177	18.9196	16.3262	15.1286	17.3603	17.5676	20.4734	22.3483	24.2688 (46)
Water storage loss:												
Store volume												170.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6480 (55)
Total storage loss												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (56)
If cylinder contains dedicated solar storage												
	20.0880	18.1440	20.0880	19.4400	20.0880	19.4400	20.0880	20.0880	19.4400	20.0880	19.4400	20.0880 (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												
	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (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												
	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (64)
								Total per year (kWh/year) = Sum(64)m =				2121.7724 (64)
Heat gains from water heating, kWh/month												
	90.2288	79.9072	84.8137	77.2691	76.6187	69.7512	68.2153	73.1622	72.5031	80.0629	83.1003	88.4761 (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	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	68.4053	60.7570	49.4109	37.4072	27.9623	23.6070	25.5082	33.1565	44.5026	56.5063	65.9511	70.3065 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	430.3068	434.7720	423.5198	399.5651	369.3265	340.9066	321.9203	317.4550	328.7073	352.6620	382.9006	411.3205 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049 (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)												
	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852 (71)
Water heating gains (Table 5)												
	121.2753	118.9096	113.9969	107.3182	102.9821	96.8767	91.6873	98.3364	100.6988	107.6114	115.4170	118.9195 (72)
Total internal gains												
	735.5349	729.9861	702.4751	659.8380	615.8185	576.9378	554.6633	564.4954	589.4562	632.3272	679.8162	716.0940 (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					6.5700	13.4839	0.7200	0.7000			0.7700	30.9417 (74)	
East					1.2100	25.1925	0.7200	0.7000			0.7700	10.6468 (76)	
South					4.2600	56.7559	0.7200	0.7000			0.7700	84.4470 (78)	
West					1.2100	25.1925	0.7200	0.7000			0.7700	10.6468 (80)	
South					4.5100	56.7559	0.7200	0.7000			0.7700	89.4028 (78)	

Solar gains	226.0852	327.8194	456.3935	582.5218	632.6133	697.0630	644.9010	603.6917	522.1900	386.7423	269.8143	183.2748	(83)
Total gains	961.6201	1057.8055	1158.8686	1242.3598	1248.4318	1274.0008	1199.5643	1168.1871	1111.6462	1019.0695	949.6305	899.3687	(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	21.2388	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136
alpha	2.4159	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342
util living area	0.9167	0.8941	0.8487	0.7740	0.6571	0.4831	0.3546	0.3629	0.5770	0.7732	0.8797	0.9250 (86)
MIT	18.9496	19.1957	19.6301	20.1226	20.5780	20.8653	20.9563	20.9540	20.7749	20.2841	19.5685	18.9251 (87)
Th 2	19.9723	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840 (88)
util rest of house	0.9057	0.8805	0.8286	0.7425	0.6049	0.4043	0.2537	0.2601	0.5022	0.7339	0.8614	0.9149 (89)
MIT 2	17.2778	17.6346	18.2502	18.9343	19.5401	19.8780	19.9631	19.9619	19.7863	19.1686	18.1738	17.2510 (90)
Living area fraction									fLA = Living area / (4) =			0.1391 (91)
MIT	17.5103	17.8517	18.4420	19.0995	19.6845	20.0153	20.1012	20.0999	19.9238	19.3237	18.3677	17.4838 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3603	17.7017	18.2920	18.9495	19.5345	19.8653	19.9512	19.9499	19.7738	19.1737	18.2177	17.3338 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	833.8276	888.3761	911.7104	875.3013	722.8306	502.4012	300.2761	299.6161	539.2523	709.5641	778.4025	789.6450 (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												
	1661.7258	1618.7443	1466.5402	1227.5318	882.5638	543.8953	308.7849	308.5988	613.6335	983.9543	1346.6151	1623.1412 (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)

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Space heating kWh	615.9563	490.8074	412.7934	253.6059	118.8416	0.0000	0.0000	0.0000	0.0000	204.1463	409.1131	620.1211 (98)
Space heating												3125.3851 (98)
Space heating per m2												(98) / (4) = 25.5342 (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												3449.6524 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	615.9563	490.8074	412.7934	253.6059	118.8416	0.0000	0.0000	0.0000	0.0000	204.1463	409.1131	620.1211 (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)	679.8635	541.7300	455.6218	279.9183	131.1717	0.0000	0.0000	0.0000	0.0000	225.3270	451.5597	684.4604 (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	210.4136	185.2697	194.1275	173.4031	169.4809	150.7930	144.2076	159.0855	159.0694	179.8394	190.9404	205.1422 (64)
Efficiency of water heater	87.6125	87.3928	86.8786	85.9271	83.9885	79.9000	79.9000	79.9000	79.9000	85.2529	86.8970	79.9000 (216)
(217)m	87.6125	87.3928	86.8786	85.9271	83.9885	79.9000	79.9000	79.9000	79.9000	85.2529	86.8970	87.6812 (217)
Fuel for water heating, kWh/month	240.1638	211.9965	223.4468	201.8026	201.7906	188.7272	180.4851	199.1058	199.0856	210.9481	219.7318	233.9637 (219)
Water heating fuel used												2511.2476 (219)
Annual totals kWh/year												
Space heating fuel - main system												3449.6524 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.0221 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.0221 (231)
Electricity for lighting (calculated in Appendix L)												483.2236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.90 * 1115 * 1.00) =										-802.7263		-802.7263 (233)
Total delivered energy for all uses												5803.4195 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3449.6524	3.7400	129.0170 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2511.2476	3.7400	93.9207 (247)
Mechanical ventilation fans	87.0221	20.4300	17.7786 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	483.2236	20.4300	98.7226 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-802.7263	20.4300	-163.9970 (252)
Total energy cost			285.7644 (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	3449.6524	0.2160	745.1249 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2511.2476	0.2160	542.4295 (264)
Space and water heating			1287.5544 (265)
Pumps and fans	162.0221	0.5190	84.0895 (267)
Energy for lighting	483.2236	0.5190	250.7931 (268)
Energy saving/generation technologies			
PV Unit	-802.7263	0.5190	-416.6149 (269)
Total kg/year			1205.8220 (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	3449.6524	1.2200	4208.5759 (261)

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Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2511.2476	1.2200	3063.7221 (264)
Space and water heating			7272.2980 (265)
Pumps and fans	162.0221	3.0700	497.4080 (267)
Energy for lighting	483.2236	3.0700	1483.4966 (268)
Energy saving/generation technologies			
PV Unit	-802.7263	3.0700	-2464.3696 (269)
Primary energy kWh/year			6788.8329 (272)
Primary energy kWh/m2/year			55.4643 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(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	-£ 40	-264 kg (21.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£40 2.15 kg/m²	B 89	B 91
Total Savings	£40 2.15 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£132	£142	-£10
Mains gas	£318	£268	£50
Space heating	£257	£258	-£1
Water heating	£94	£53	£41
Lighting	£99	£99	£0
Generated (PV)	-£164	-£164	£0
Total cost of fuels	£286	£246	£40
Total cost of uses	£286	£246	£40
Delivered energy	47 kWh/m²	37 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	43 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (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					4.8600
Infiltration rate					0.2430 (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)	=	0.2430 (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	0.3098	0.3038	0.2977	0.2673	0.2612	0.2309	0.2309	0.2248	0.2430	0.2612	0.2734	0.2855 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5598	0.5538	0.5477	0.5173	0.5112	0.5000	0.5000	0.5000	0.5000	0.5112	0.5234	0.5355 (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)			13.2500	1.3258	17.5663		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			61.2000	0.1800	11.0160	75.0000	4590.0000 (28a)
140mm Timber Frame	160.7800	19.8800	140.9000	0.1900	26.7710	9.0000	1268.1000 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Total net area of external elements Aum(A, m ²)			283.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8205		(33)
Timber GF			92.1100			9.0000	828.9900 (32c)
Timber FF			131.3300			9.0000	1181.9700 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10623.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							86.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0436 (36)
Total fabric heat loss						(33) + (36) =	85.8641 (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	57.4356	56.8124	56.1891	53.0727	52.4495	51.2978	51.2978	51.2978	51.2978	52.4495	53.6960	54.9426 (38)
Average = Sum(39)m / 12 =	143.2997	142.6765	142.0532	138.9368	138.3136	137.1619	137.1619	137.1619	137.1619	138.3136	139.5601	140.8066 (39)
												139.3840 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1707	1.1657	1.1606	1.1351	1.1300	1.1206	1.1206	1.1206	1.1206	1.1300	1.1402	1.1504 (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												2.8721 (42)
Average daily hot water use (litres/day)												102.4131 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy content (annual)	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1611.3564 (45)
	25.0595	21.9172	22.6166	19.7177	18.9196	16.3262	15.1286	17.3603	17.5676	20.4734	22.3483	24.2688 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2924 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6979 (55)
Total storage loss												
	21.6341	19.5405	21.6341	20.9363	21.6341	20.9363	21.6341	21.6341	20.9363	21.6341	20.9363	21.6341 (56)
If cylinder contains dedicated solar storage												
	13.0944	11.8272	13.0944	12.6720	13.0944	12.6720	13.0944	13.0944	12.6720	13.0944	12.6720	13.0944 (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												
	203.4199	178.9529	185.7381	159.8815	149.6929	131.4183	124.1870	139.9954	146.8984	171.4500	184.1724	198.1485 (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												1.1255 (H8)
Utilisation factor												0.5887 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.4131 (H14)
Volume ratio Veff/V												1.0692 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-938.8268 (H17)
Solar input	-27.2241	-45.4292	-77.3711	-103.6926	-128.1034	-125.9461	-124.2817	-108.5855	-85.0442	-58.0752	-32.2917	-22.7819 (63)
								Solar input (sum of months) = Sum (63)m =				-938.8268 (63)
Output from w/h												
	176.1958	133.5237	108.3670	56.1889	21.5895	5.4722	0.0000	31.4099	61.8542	113.3748	151.8807	175.3666 (64)
								Total per year (kWh/year) = Sum (64)m =				1035.2233 (64)
Heat gains from water heating, kWh/month												
	84.6339	74.8538	78.1022	66.4518	60.7883	54.2514	52.1989	57.8902	62.7664	73.3514	77.6858	82.8812 (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	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	68.4053	60.7570	49.4109	37.4072	27.9623	23.6070	25.5082	33.1565	44.5026	56.5063	65.9511	70.3065 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	430.3068	434.7720	423.5198	399.5651	369.3265	340.9066	321.9203	317.4550	328.7073	352.6620	382.9006	411.3205 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049 (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)												
	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852 (71)
Water heating gains (Table 5)												
	113.7553	111.3895	104.9761	92.2941	81.7048	75.3492	70.1598	77.8094	87.1755	98.5906	107.8970	111.3994 (72)
Total internal gains												
	728.0148	722.4660	693.4542	644.8139	594.5411	555.4103	533.1357	543.9684	575.9329	623.3064	672.2962	708.5739 (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		6.5700	10.6334	0.7200	0.7000	0.7700	24.4006 (74)
East		1.2100	19.6403	0.7200	0.7000	0.7700	8.3004 (76)
South		4.2600	46.7521	0.7200	0.7000	0.7700	69.5623 (78)
West		1.2100	19.6403	0.7200	0.7000	0.7700	8.3004 (80)
South		4.5100	46.7521	0.7200	0.7000	0.7700	73.6446 (78)

Solar gains	184.2083	313.6415	431.4755	542.9347	618.9051	620.0181	595.3753	537.2813	469.5566	347.0109	220.5495	157.7372 (83)
Total gains	912.2231	1036.1075	1124.9297	1187.7486	1213.4462	1175.4284	1128.5110	1081.2497	1045.4896	970.3172	892.8457	866.3111 (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	20.5922	20.6821	20.7729	21.2388	21.3345	21.5136	21.5136	21.5136	21.5136	21.3345	21.1439	20.9568
alpha	2.3728	2.3788	2.3849	2.4159	2.4223	2.4342	2.4342	2.4342	2.4342	2.4223	2.4096	2.3971
util living area												
	0.9347	0.9114	0.8768	0.8175	0.7281	0.6001	0.4734	0.5058	0.6728	0.8306	0.9104	0.9410 (86)
MIT	18.5764	18.8675	19.3048	19.8676	20.3565	20.7234	20.8890	20.8653	20.6103	19.9894	19.2064	18.5421 (87)
Th 2	19.9435	19.9476	19.9517	19.9723	19.9764	19.9840	19.9840	19.9840	19.9840	19.9764	19.9681	19.9599 (88)
util rest of house												
	0.9262	0.9000	0.8605	0.7920	0.6869	0.5338	0.3821	0.4157	0.6127	0.8019	0.8972	0.9333 (89)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	16.7247	17.1438	17.7708	18.5766	19.2481	19.7232	19.9066	19.8850	19.5932	18.7624	17.6492	16.6845 (90)
Living area fraction									fLA = Living area / (4) =			0.1391 (91)
MIT	16.9822	17.3835	17.9841	18.7561	19.4023	19.8623	20.0432	20.0213	19.7346	18.9330	17.8657	16.9428 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8322	17.2335	17.8341	18.6061	19.2523	19.7123	19.8932	19.8713	19.5846	18.7830	17.7157	16.7928 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8902	0.8600	0.8177	0.7507	0.6531	0.5141	0.3733	0.4048	0.5858	0.7601	0.8573	0.8993 (94)	
Useful gains	812.0563	891.0238	919.8611	891.6028	792.5455	604.3294	421.2228	437.6429	612.4324	737.4927	765.4780	779.0807 (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													
	1795.8605	1759.6983	1610.0472	1348.5370	1044.5814	701.2139	451.6977	476.1333	752.2793	1131.8236	1481.5274	1773.1556 (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													
	731.9503	583.7492	513.4985	328.9926	187.5147	0.0000	0.0000	0.0000	0.0000	293.3822	515.5556	739.5917 (98)	
Space heating												3894.2348 (98)	
Space heating per m2												31.8156 (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													4298.2724 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	731.9503	583.7492	513.4985	328.9926	187.5147	0.0000	0.0000	0.0000	0.0000	293.3822	515.5556	739.5917 (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)	807.8922	644.3148	566.7753	363.1265	206.9699	0.0000	0.0000	0.0000	0.0000	323.8214	569.0459	816.3264 (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	176.1958	133.5237	108.3670	56.1889	21.5895	5.4722	0.0000	31.4099	61.8542	113.3748	151.8807	175.3666 (64)	
Efficiency of water heater (217)m	88.3056	88.3963	88.5339	88.8640	89.3644	79.9000	79.9000	79.9000	79.9000	87.3399	87.9207	88.3327 (217)	
Fuel for water heating, kWh/month	199.5296	151.0512	122.4017	63.2302	24.1589	6.8488	0.0000	39.3115	77.4145	129.8087	172.7473	198.5296 (219)	
Water heating fuel used												1185.0321 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4298.2724 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													87.0221 (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													212.0221 (231)
Electricity for lighting (calculated in Appendix L)													483.2236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 1004 * 1.00) =									-722.8773				-722.8773 (233)
Total delivered energy for all uses													5455.6731 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4298.2724	3.4800	149.5799 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1185.0321	3.4800	41.2391 (247)	
Mechanical ventilation fans	87.0221	13.1900	11.4782 (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	483.2236	13.1900	63.7372 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-722.8773	13.1900	-95.3475 (252)	
Total energy cost			307.1744 (255)	

11a. SAP rating - Individual heating systems

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Energy cost deflator (Table 12):
 Energy cost factor (ECF) $[(255) \times (256)] / [(4) + 45.0] = 0.4200$ (256)
 SAP value 0.7707 (257)
 SAP rating (Section 12) 89.2489
 SAP band 89 (258)
 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	4298.2724	0.2160	928.4268 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1185.0321	0.2160	255.9669 (264)
Space and water heating			1184.3938 (265)
Pumps and fans	212.0221	0.5190	110.0395 (267)
Energy for lighting	483.2236	0.5190	250.7931 (268)
Energy saving/generation technologies			
PV Unit	-722.8773	0.5190	-375.1733 (269)
Total kg/year			1170.0530 (272)
CO2 emissions per m2			9.5600 (273)
EI value			90.6340
EI rating			91 (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	61.2000 (1b)	x 2.4100 (2b)	= 147.4920 (1b) - (3b)
First floor	61.2000 (1c)	x 2.6700 (2c)	= 163.4040 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.4000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 310.8960 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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															4.8600		
Number of sides sheltered															0.2430 (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) =					0.2430 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	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																	
	0.2673	0.2491	0.2491	0.2369	0.2369	0.2248	0.2248	0.2126	0.2126	0.2309	0.2248	0.2369 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:																	0.5000 (23a)
Effective ac	0.5173	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 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)			13.2500	1.3258	17.5663		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			61.2000	0.1800	11.0160	75.0000	4590.0000 (28a)
140mm Timber Frame	160.7800	19.8800	140.9000	0.1900	26.7710	9.0000	1268.1000 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Total net area of external elements Aum(A, m ²)			283.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.8205		(33)
Timber GF			92.1100			9.0000	828.9900 (32c)
Timber FF			131.3300			9.0000	1181.9700 (32c)
Internal Floor			61.2000			18.0000	1101.6000 (32d)
Internal Ceiling			61.2000			18.0000	1101.6000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10623.0600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							86.7897 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.0436 (36)
Total fabric heat loss						(33) + (36) =	85.8641 (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	53.0727	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978	51.2978 (38)
Heat transfer coeff	138.9368	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619	137.1619 (39)
Average = Sum(39)m / 12 =												137.3098 (39)
HLP	1.1351	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206	1.1206 (40)
HLP (average)												1.1218 (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 2.8721 (42)
 Average daily hot water use (litres/day) 102.4131 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Calculation Type: New Build (As Built)

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

Energy conte	112.6544	108.5579	104.4613	100.3648	96.2683	92.1718	92.1718	96.2683	100.3648	104.4613	108.5579	112.6544 (44)
Energy content (annual)	167.0632	146.1145	150.7771	131.4511	126.1305	108.8410	100.8572	115.7351	117.1174	136.4890	148.9884	161.7918 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1611.3564 (45)
	25.0595	21.9172	22.6166	19.7177	18.9196	16.3262	15.1286	17.3603	17.5676	20.4734	22.3483	24.2688 (46)
Water storage loss:												
Store volume												190.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.2924 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.6979 (55)
Total storage loss												
	21.6341	19.5405	21.6341	20.9363	21.6341	20.9363	21.6341	21.6341	20.9363	21.6341	20.9363	21.6341 (56)
If cylinder contains dedicated solar storage												
	13.0944	11.8272	13.0944	12.6720	13.0944	12.6720	13.0944	13.0944	12.6720	13.0944	12.6720	13.0944 (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												
	203.4199	178.9529	185.7381	159.8815	149.6929	131.4183	124.1870	139.9954	146.8984	171.4500	184.1724	198.1485 (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												1.2517 (H8)
Utilisation factor												0.5502 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.4131 (H14)
Volume ratio Veff/V												1.0692 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-975.7466 (H17)
Solar input	-32.0316	-45.5469	-78.2842	-105.6235	-123.4470	-133.0981	-126.6990	-115.4778	-90.2346	-62.0551	-37.8850	-25.3638 (63)
								Solar input (sum of months) =	Sum (63)m =			-975.7466 (63)
Output from w/h												
	171.3883	133.4060	107.4539	54.2580	26.2459	0.0000	0.0000	24.5176	56.6639	109.3950	146.2874	172.7848 (64)
								Total per year (kWh/year) =	Sum (64)m =			1002.4007 (64)
Heat gains from water heating, kWh/month												
	84.6339	74.8538	78.1022	66.4518	60.7883	54.2514	52.1989	57.8902	62.7664	73.3514	77.6858	82.8812 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278	172.3278 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	68.4053	60.7570	49.4109	37.4072	27.9623	23.6070	25.5082	33.1565	44.5026	56.5063	65.9511	70.3065 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	430.3068	434.7720	423.5198	399.5651	369.3265	340.9066	321.9203	317.4550	328.7073	352.6620	382.9006	411.3205 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049	55.1049 (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)												
	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852	-114.8852 (71)
Water heating gains (Table 5)												
	113.7553	111.3895	104.9761	92.2941	81.7048	75.3492	70.1598	77.8094	87.1755	98.5906	107.8970	111.3994 (72)
Total internal gains												
	728.0148	722.4660	693.4542	644.8139	594.5411	555.4103	533.1357	543.9684	575.9329	623.3064	672.2962	708.5739 (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	6.5700	13.4839	0.7200	0.7000	0.7700	30.9417 (74)
East	1.2100	25.1925	0.7200	0.7000	0.7700	10.6468 (76)
South	4.2600	56.7559	0.7200	0.7000	0.7700	84.4470 (78)
West	1.2100	25.1925	0.7200	0.7000	0.7700	10.6468 (80)
South	4.5100	56.7559	0.7200	0.7000	0.7700	89.4028 (78)

Solar gains	226.0852	327.8194	456.3935	582.5218	632.6133	697.0630	644.9010	603.6917	522.1900	386.7423	269.8143	183.2748 (83)
Total gains	954.1000	1050.2855	1149.8478	1227.3357	1227.1544	1252.4733	1178.0368	1147.6601	1098.1229	1010.0486	942.1104	891.8487 (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	21.2388	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136	21.5136
alpha	2.4159	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342	2.4342
util living area												
	0.9179	0.8955	0.8506	0.7778	0.6635	0.4894	0.3603	0.3685	0.5817	0.7760	0.8814	0.9262 (86)
MIT	18.9404	19.1872	19.6213	20.1115	20.5682	20.8613	20.9548	20.9524	20.7707	20.2774	19.5604	18.9157 (87)
Th 2	19.9723	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840	19.9840 (88)
util rest of house												
	0.9070	0.8819	0.8307	0.7465	0.6115	0.4100	0.2581	0.2645	0.5068	0.7369	0.8632	0.9162 (89)

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MIT 2	17.2649	17.6227	18.2382	18.9198	19.5289	19.8746	19.9623	19.9611	19.7822	19.1602	18.1626	17.2376 (90)
Living area fraction									fLA = Living area / (4) =			0.1391 (91)
MIT	17.4979	17.8402	18.4305	19.0855	19.6734	20.0118	20.1003	20.0989	19.9197	19.3155	18.3569	17.4709 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3479	17.6902	18.2805	18.9355	19.5234	19.8618	19.9503	19.9489	19.7697	19.1655	18.2069	17.3209 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8686	0.8414	0.7888	0.7083	0.5849	0.3998	0.2545	0.2607	0.4893	0.6991	0.8216	0.8795 (94)	
Useful gains	828.7397	883.6989	906.9634	869.3422	717.8074	500.6798	299.8286	299.1565	537.3029	706.0995	774.0058	784.3978 (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	1659.9998	1617.1708	1464.9595	1225.6117	881.0475	543.4056	308.6587	308.4691	613.0688	982.8388	1345.1379	1621.3774 (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	618.4575	492.8931	415.1491	256.5140	121.4506	0.0000	0.0000	0.0000	0.0000	205.8940	411.2151	622.7128 (98)	
Space heating												3144.2862 (98)	
Space heating per m2										(98) / (4) =		25.6886 (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													3470.5146 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	618.4575	492.8931	415.1491	256.5140	121.4506	0.0000	0.0000	0.0000	0.0000	205.8940	411.2151	622.7128 (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)	682.6242	544.0321	458.2220	283.1281	134.0514	0.0000	0.0000	0.0000	0.0000	227.2561	453.8798	687.3210 (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	171.3883	133.4060	107.4539	54.2580	26.2459	0.0000	0.0000	24.5176	56.6639	109.3950	146.2874	172.7848 (64)	
Efficiency of water heater (217)m	88.0416	88.0873	88.1722	88.5301	88.4941	79.9000	79.9000	79.9000	79.9000	86.5772	87.5244	79.9000 (216)	
Fuel for water heating, kWh/month	194.6674	151.4475	121.8683	61.2876	29.6584	0.0000	0.0000	30.6853	70.9185	126.3554	167.1390	196.2589 (219)	
Water heating fuel used												1150.2863 (219)	
Annual totals kWh/year													
Space heating fuel - main system												3470.5146 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)													
mechanical ventilation fans (SFP = 0.2294)													87.0221 (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													212.0221 (231)
Electricity for lighting (calculated in Appendix L)													483.2236 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.90 * 1115 * 1.00) =									-802.7263				-802.7263 (233)
Total delivered energy for all uses													4513.3204 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3470.5146	3.7400	129.7972 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1150.2863	3.7400	43.0207 (247)	
Mechanical ventilation fans	87.0221	20.4300	17.7786 (249)	
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)	
Pump for solar water heating	50.0000	20.4300	10.2150 (249)	
Energy for lighting	483.2236	20.4300	98.7226 (250)	
Additional standing charges			95.0000 (251)	
Energy saving/generation technologies				
PV Unit	-802.7263	20.4300	-163.9970 (252)	
Total energy cost			245.8597 (255)	

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

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 kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3470.5146	0.2160	749.6311 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1150.2863	0.2160	248.4618 (264)
Space and water heating			998.0930 (265)
Pumps and fans	212.0221	0.5190	110.0395 (267)
Energy for lighting	483.2236	0.5190	250.7931 (268)
Energy saving/generation technologies			
PV Unit	-802.7263	0.5190	-416.6149 (269)
Total kg/year			942.3106 (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	3470.5146	1.2200	4234.0278 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1150.2863	1.2200	1403.3493 (264)
Space and water heating			5637.3771 (265)
Pumps and fans	212.0221	3.0700	650.9080 (267)
Energy for lighting	483.2236	3.0700	1483.4966 (268)
Energy saving/generation technologies			
PV Unit	-802.7263	3.0700	-2464.3696 (269)
Primary energy kWh/year			5307.4120 (272)
Primary energy kWh/m2/year			43.3612 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	86.8 (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	410.38 (P1)
Transmission heat loss coefficient	85.86 (P7)
Summer heat loss coefficient	496.25 (P2)

Overhangs

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

Solar shading

Orientation	Z_blinds	Solar access	Z_overhangs	Z_summer
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	6.5700	87.1704	0.7200	0.7000	0.9000	233.8031
East	1.2100	125.2818	0.7200	0.7000	0.9000	61.8855
South	4.2600	118.5567	0.7200	0.7000	0.9000	206.1822
West	1.2100	125.2818	0.7200	0.7000	0.9000	61.8855
South	4.5100	118.5567	0.7200	0.7000	0.9000	218.2821
total:						782.0383

Solar gains	Jun	Jul	Aug	(P3)
Internal gains	836	782	716	
Total summer gains	574	552	561	
	1409	1334	1278	(P5)
Summer gain/loss ratio	2.84	2.69	2.58	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 86.8)	1.39	1.39	1.39	
Threshold temperature	19.63	21.38	21.27	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Assessment of likelihood of high internal temperature: Slight