

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-235			Issued on Date	12/12/2023
Assessment Reference	As Built	Prop Type Ref	G Det Op		
Property	64, Pembers Farm Avenue, Fair Oak, EASTLEIGH, SO50 7QL				
SAP Rating	88 B	DER	12.25	TER	16.89
Environmental	89 B	% DER<TER	27.48		
CO ₂ Emissions (t/year)	1.18	DFEE	48.04	TFEE	57.21
General Requirements Compliance	Pass	% DFEE<TFEE	16.03		
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 124 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) 16.89 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.25 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)57.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.0 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)	0.20 (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: 4.49 (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: 1.96 m², No overhang
Windows facing East: 9.77 m², No overhang
Windows facing South: 1.96 m², No overhang
Windows facing West: 6.17 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.99 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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	(8)
Measured/design AP50												4.4900
Infiltration rate												0.2245 (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) =	0.2245 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2862	0.2806	0.2750	0.2470	0.2413	0.2133	0.2133	0.2077	0.2245	0.2413	0.2526	0.2638 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5362	0.5306	0.5250	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5026	0.5138 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.2934		(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) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.6127	Feb 55.0306	Mar 54.4486	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 52.1203	Dec 53.2844 (38)
Heat transfer coeff	145.0602	144.4781	143.8961	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.5678	142.7319 (39)
Average = Sum(39)m / 12 =												142.2374 (39)
HLP	Jan 1.1717	Feb 1.1670	Mar 1.1623	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1435	Dec 1.1529 (40)
HLP (average)												1.1489 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (65)
Total per year (kWh/year) = Sum (64)m =												2123.5464 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.2494	24.2027	19.6829	14.9012	11.1389	9.4039	10.1612	13.2080	17.7277	22.5094	26.2718	28.0067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	121.3575	118.9892	114.0711	107.3850	103.0442	96.9321	91.7369	98.3933	100.7583	107.6786	115.4928	118.9991	(72)
Total internal gains	507.8412	505.4362	488.4130	460.7967	432.3089	405.3032	388.0662	394.7592	409.2294	437.0799	469.0410	493.4409	(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				1.9600	10.6334	0.7200	0.7000	0.7700	7.2793 (74)			
East				4.2600	19.6403	0.7200	0.7000	0.7700	29.2227 (76)			
South				1.9600	46.7521	0.7200	0.7000	0.7700	32.0052 (78)			
West				6.1700	19.6403	0.7200	0.7000	0.7700	42.3249 (80)			
East				4.5100	19.6403	0.7200	0.7000	0.7700	30.9377 (76)			
Solar gains	141.7699	266.8105	420.5745	594.9619	719.9178	734.5387	700.1961	606.3967	482.1672	310.9853	174.7042	118.0028 (83)
Total gains	649.6110	772.2467	908.9875	1055.7586	1152.2267	1139.8419	1088.2623	1001.1559	891.3966	748.0652	643.7452	611.4437 (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	20.6112	20.6942	20.7780	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1197	20.9474	
alpha	2.3741	2.3796	2.3852	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4080	2.3965	
util living area	0.9675	0.9504	0.9173	0.8517	0.7517	0.6215	0.4967	0.5449	0.7378	0.8929	0.9533	0.9715	(86)
MIT	18.2131	18.5223	19.0471	19.7264	20.2961	20.6922	20.8725	20.8359	20.5014	19.7405	18.8741	18.1757	(87)
Th 2	19.9427	19.9465	19.9503	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9654	19.9578	(88)
util rest of house	0.9628	0.9434	0.9052	0.8293	0.7116	0.5543	0.4016	0.4506	0.6808	0.8718	0.9456	0.9675	(89)
MIT 2	16.2030	16.6521	17.4099	18.3832	19.1659	19.6759	19.8780	19.8453	19.4558	18.4220	17.1771	16.1598	(90)
Living area fraction									fLA = Living area / (4) =			0.1551	(91)
MIT	16.5147	16.9422	17.6638	18.5915	19.3412	19.8335	20.0323	19.9989	19.6180	18.6265	17.4403	16.4729	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.3647	16.7922	17.5138	18.4415	19.1912	19.6835	19.8823	19.8489	19.4680	18.4765	17.2903	16.3229	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	609.3437	704.2926	787.5566	831.2206	779.2132	608.2466	427.7705	439.1057	577.5307	621.2247	589.1839	577.7752	(94)
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	1750.1085	1718.1581	1584.8494	1348.2388	1058.5163	718.3080	463.7892	487.3433	758.5042	1112.9678	1442.6215	1730.3181	(97)

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Month fraction	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	848.7290	681.3176	593.1859	372.2530	207.8015	0.0000	0.0000	0.0000	0.0000	365.8569	614.4751	857.4919 (98)
Space heating												4541.1109 (98)
Space heating per m2										(98) / (4) =		36.6810 (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												5012.2637 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	848.7290	681.3176	593.1859	372.2530	207.8015	0.0000	0.0000	0.0000	0.0000	365.8569	614.4751	857.4919 (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)	936.7870	752.0062	654.7305	410.8753	229.3615	0.0000	0.0000	0.0000	0.0000	403.8156	678.2286	946.4591 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Efficiency of water heater (217)m	88.2505	88.0766	87.7022	86.8997	85.4568	79.9000	79.9000	79.9000	79.9000	86.7684	87.8104	79.9000 (216)
Fuel for water heating, kWh/month	238.6361	210.5333	221.5377	199.7106	198.4860	188.8772	180.6241	199.2653	199.2469	207.4368	217.6331	232.4858 (219)
Water heating fuel used												2494.4728 (219)
Annual totals kWh/year												
Space heating fuel - main system												5012.2637 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.9666 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.9666 (231)
Electricity for lighting (calculated in Appendix L)												481.2328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118 (233)
Total delivered energy for all uses												7305.0241 (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	5012.2637	0.2160	1082.6490 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2494.4728	0.2160	538.8061 (264)
Space and water heating			1621.4551 (265)
Pumps and fans	162.9666	0.5190	84.5796 (267)
Energy for lighting	481.2328	0.5190	249.7598 (268)
Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total CO2, kg/year			1516.7663 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.2500 (273)

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

DER			12.2500 ZC1
Total Floor Area		TFA	123.8000
Assumed number of occupants		N	2.8769
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.8850 ZC2
CO2 emissions from cooking, equation (L16)			1.5189 ZC3
Total CO2 emissions			27.6539 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			27.6539 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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1273 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3773 (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) =	0.3773 (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	0.4810	0.4716	0.4622	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983 (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)			18.8600	1.3258	25.0038			(27)					
150mm EPS B&B			62.6000	0.1300	8.1380			(28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1800	25.8192			(29a)					
400mm Mineral Wool	61.2000		61.2000	0.1300	7.9560			(30)					
Bay Plane	1.4000		1.4000	0.1300	0.1820			(30)					
Total net area of external elements Aum(A, m2)			289.6200					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	69.2190		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4572	(36)					
Total fabric heat loss						(33) + (36) =	81.6762	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 63.8532	Feb 63.3873	Mar 62.9306	Apr 60.7855	May 60.3842	Jun 58.5159	Jul 58.5159	Aug 58.1699	Sep 59.2355	Oct 60.3842	Nov 61.1961	Dec 62.0449	(38)
Heat transfer coeff	145.5294	145.0635	144.6068	142.4617	142.0603	140.1920	140.1920	139.8461	140.9117	142.0603	142.8723	143.7211	(39)
Average = Sum(39)m / 12 =												142.4598	(39)
HLP	Jan 1.1755	Feb 1.1718	Mar 1.1681	Apr 1.1507	May 1.1475	Jun 1.1324	Jul 1.1324	Aug 1.1296	Sep 1.1382	Oct 1.1475	Nov 1.1541	Dec 1.1609	(40)
HLP (average)												1.1507	(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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Daily hot water use	Jan 112.7784	Feb 108.6774	Mar 104.5763	Apr 100.4753	May 96.3743	Jun 92.2732	Jul 92.2732	Aug 96.3743	Sep 100.4753	Oct 104.5763	Nov 108.6774	Dec 112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum(45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (46)
Water storage loss:												170.0000 (47)
Store volume												1.5003 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
215.6248	189.9714	199.3208	178.4130	174.6471	155.7780	149.3459	164.2402	164.0634	185.0170	195.9696	210.3476	(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	(63)
Solar input (sum of months) = Sum(63)m =												(63)
Output from w/h												
215.6248	189.9714	199.3208	178.4130	174.6471	155.7780	149.3459	164.2402	164.0634	185.0170	195.9696	210.3476	(64)
Heat gains from water heating, kWh/month												
94.3118	83.5934	88.8907	81.2093	80.6867	73.6832	72.2741	77.2265	76.4381	84.1347	87.0469	92.5572	(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	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
27.2494	24.2027	19.6829	14.9012	11.1389	9.4039	10.1612	13.2080	17.7277	22.5094	26.2718	28.0067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)												
126.7632	124.3949	119.4768	112.7907	108.4499	102.3378	97.1426	103.7990	106.1640	113.0843	120.8985	124.4048	(72)
Total internal gains												
513.2469	510.8419	493.8187	466.2024	437.7146	410.7089	393.4719	400.1649	414.6351	442.4856	474.4467	498.8466	(73)

6. Solar gains

[Jan]												
	Area	Solar flux										
	m2	Table 6a	Specific data									
		W/m2	or Table 6b									
North	1.9600	10.6334	0.6300				0.7000		0.7700		6.3694	(74)
East	8.7700	19.6403	0.6300				0.7000		0.7700		52.6403	(76)
South	1.9600	46.7521	0.6300				0.7000		0.7700		28.0046	(78)
West	6.1700	19.6403	0.6300				0.7000		0.7700		37.0343	(80)
Solar gains	124.0486	233.4592	368.0027	520.5917	629.9280	642.7214	612.6716	530.5971	421.8963	272.1122	152.8662	103.2525 (83)
Total gains	637.2955	744.3011	861.8214	986.7941	1067.6427	1053.4303	1006.1435	930.7620	836.5314	714.5977	627.3129	602.0991 (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	59.0755	59.2652	59.4524	60.3476	60.5181	61.3246	61.3246	61.4763	61.0114	60.5181	60.1742	59.8188
alpha	4.9384	4.9510	4.9635	5.0232	5.0345	5.0883	5.0883	5.0984	5.0674	5.0345	5.0116	4.9879
util living area												
0.9990	0.9976	0.9928	0.9731	0.9093	0.7622	0.5923	0.6549	0.8911	0.9865	0.9979	0.9993	(86)
MIT	19.6456	19.7963	20.0615	20.4209	20.7341	20.9283	20.9841	20.9743	20.8275	20.4137	19.9691	19.6275 (87)
Th 2	19.9396	19.9427	19.9456	19.9596	19.9622	19.9745	19.9745	19.9767	19.9697	19.9622	19.9569	19.9514 (88)
util rest of house												
0.9987	0.9968	0.9901	0.9621	0.8712	0.6727	0.4648	0.5267	0.8304	0.9792	0.9970	0.9990	(89)
MIT 2	18.1263	18.3487	18.7374	19.2640	19.6914	19.9245	19.9684	19.9656	19.8223	19.2616	18.6118	18.1081 (90)
Living area fraction												
fLA = Living area / (4) =												0.1551 (91)
MIT	18.3619	18.5732	18.9427	19.4434	19.8531	20.0802	20.1259	20.1220	19.9782	19.4403	18.8223	18.3437 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3619	18.5732	18.9427	19.4434	19.8531	20.0802	20.1259	20.1220	19.9782	19.4403	18.8223	18.3437 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9951	0.9863	0.9548	0.8663	0.6829	0.4845	0.5461	0.8310	0.9739	0.9954	0.9984	(94)
Useful gains	635.9130	740.6605	850.0472	942.2180	924.9162	719.3934	487.4560	508.3075	695.1832	695.9608	624.4453	601.1180	(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													
	2046.4265	1983.4884	1799.3030	1502.0301	1158.2323	768.2766	494.3055	520.5110	828.3039	1255.8594	1674.7975	2032.7504	(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													
	1049.4221	835.1803	706.2463	403.0647	173.5872	0.0000	0.0000	0.0000	0.0000	416.5646	756.2535	1065.1345	(98)
Space heating												5405.4532	(98)
Space heating per m2												(98) / (4) =	43.6628 (99)

8c. Space cooling requirement

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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													5781.2334 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1049.4221	835.1803	706.2463	403.0647	173.5872	0.0000	0.0000	0.0000	0.0000	416.5646	756.2535	1065.1345	(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)	1122.3765	893.2410	755.3436	431.0852	185.6547	0.0000	0.0000	0.0000	0.0000	445.5236	808.8273	1139.1813	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	215.6248	189.9714	199.3208	178.4130	174.6471	155.7780	149.3459	164.2402	164.0634	185.0170	195.9696	210.3476	(64)
Efficiency of water heater (217)m	88.4779	88.3058	87.9056	86.9239	84.7976	79.8000	79.8000	79.8000	79.8000	86.9158	88.0697	79.8000	(216)
Fuel for water heating, kWh/month	243.7048	215.1289	226.7440	205.2520	205.9574	195.2105	187.1503	205.8148	205.5933	212.8693	222.5164	237.5679	(219)
Water heating fuel used												2563.5097	(219)
Annual totals kWh/year													
Space heating fuel - main system												5781.2334	(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)												481.2328	(232)
Total delivered energy for all uses												8900.9760	(238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	5781.2334	0.2160	1248.7464 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2563.5097	0.2160	553.7181 (264)
Space and water heating			1802.4645 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	481.2328	0.5190	249.7598 (268)
Total CO ₂ , kg/m ² /year			2091.1494 (272)
Emissions per m ² for space and water heating			14.5595 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m ² for lighting			2.0174 (272b)
Emissions per m ² for pumps and fans			0.3144 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.5595 * 1.00) + 2.0174 + 0.3144, rounded to 2 d.p.			16.8900 (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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					4.4900
Infiltration rate					0.3518 (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) =	0.3518 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4485	0.4397	0.4309	0.3870	0.3782	0.3342	0.3342	0.3254	0.3518	0.3782	0.3958	0.4133 (22b)
	0.6006	0.5967	0.5929	0.5749	0.5715	0.5558	0.5558	0.5529	0.5619	0.5715	0.5783	0.5854 (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)			14.3500	1.3258	19.0246		(27)
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)
Total net area of external elements Aum(A, m ²)			289.6200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(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) =	10212.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							82.4937 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)
Total fabric heat loss						(33) + (36) =	89.4475 (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	62.2861	61.8810	61.4839	59.6190	59.2701	57.6458	57.6458	57.3450	58.2715	59.2701	59.9760	60.7139 (38)
Heat transfer coeff	151.7336	151.3285	150.9315	149.0665	148.7176	147.0933	147.0933	146.7925	147.7190	148.7176	149.4235	150.1614 (39)
Average = Sum(39)m / 12 =												149.0649 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2256	1.2224	1.2192	1.2041	1.2013	1.1882	1.1882	1.1857	1.1932	1.2013	1.2070	1.2129 (40)
HLP (average)												1.2041 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1613.1304 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5400	31.0835	32.0754	27.9641	26.8322	23.1542	21.4558	24.6208	24.9148	29.0358	31.6949	34.4186 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.2494	24.2027	19.6829	14.9012	11.1389	9.4039	10.1612	13.2080	17.7277	22.5094	26.2718	28.0067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	47.7688	46.2552	43.1121	38.8391	36.0648	32.1586	28.8384	33.0925	34.6039	39.0267	44.0207	46.2616	(72)
Total internal gains	431.2525	429.7023	414.4540	389.2507	362.3296	337.5297	322.1677	326.4584	340.0750	365.4279	394.5689	417.7034	(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				1.9600	10.6334	0.7200	0.7000		0.7700		7.2793 (74)	
East				4.2600	19.6403	0.7200	0.7000		0.7700		29.2227 (76)	
South				1.9600	46.7521	0.7200	0.7000		0.7700		32.0052 (78)	
West				6.1700	19.6403	0.7200	0.7000		0.7700		42.3249 (80)	
East				4.5100	19.6403	0.7200	0.7000		0.7700		30.9377 (76)	
Solar gains	141.7699	266.8105	420.5745	594.9619	719.9178	734.5387	700.1961	606.3967	482.1672	310.9853	174.7042	118.0028 (83)
Total gains	573.0224	696.5128	835.0285	984.2126	1082.2473	1072.0684	1022.3638	932.8551	822.2422	676.4133	569.2732	535.7062 (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	18.6964	18.7464	18.7957	19.0309	19.0755	19.2862	19.2862	19.3257	19.2045	19.0755	18.9854	18.8921	
alpha	2.2464	2.2498	2.2530	2.2687	2.2717	2.2857	2.2857	2.2884	2.2803	2.2717	2.2657	2.2595	
util living area	0.9723	0.9566	0.9262	0.8666	0.7742	0.6493	0.5280	0.5781	0.7658	0.9079	0.9608	0.9761	(86)
MIT	17.9023	18.2227	18.7771	19.4979	20.1377	20.6102	20.8292	20.7836	20.3819	19.5251	18.5854	17.8511	(87)
Th 2	19.8995	19.9022	19.9047	19.9167	19.9190	19.9295	19.9295	19.9314	19.9254	19.9190	19.9144	19.9097	(88)
util rest of house	0.9684	0.9504	0.9153	0.8456	0.7354	0.5817	0.4281	0.4804	0.7108	0.8890	0.9541	0.9726	(89)
MIT 2	17.0599	17.3787	17.9271	18.6371	19.2446	19.6746	19.8467	19.8197	19.4875	18.6782	17.7498	17.0157	(90)
Living area fraction	17.1905	17.5096	18.0589	18.7706	19.3831	19.8197	19.9991	19.9692	19.6262	18.8095	17.8794	17.1452	(91)
MIT	17.1905	17.5096	18.0589	18.7706	19.3831	19.8197	19.9991	19.9692	19.6262	18.8095	17.8794	17.1452	(92)
Temperature adjustment	17.1905	17.5096	18.0589	18.7706	19.3831	19.8197	19.9991	19.9692	19.6262	18.8095	17.8794	17.1452	(93)
adjusted MIT	17.1905	17.5096	18.0589	18.7706	19.3831	19.8197	19.9991	19.9692	19.6262	18.8095	17.8794	17.1452	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	546.8402	648.8993	743.9713	805.2720	771.6038	615.2507	444.9290	451.7637	569.5137	584.1864	533.1878	514.2898	(94)
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	1955.9268	1908.1907	1744.6019	1471.3767	1142.6094	767.7838	499.9824	523.9360	816.3235	1220.9002	1610.6942	1943.8754	(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	1048.3604	846.2438	744.4691	479.5953	276.0281	0.0000	0.0000	0.0000	0.0000	473.7151	775.8046	1063.6117	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 46.1052 (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	

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Calculation Type: New Build (As Built)



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Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1382.6773	1088.4907	1115.6233	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6924	0.7570	0.7228	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	957.3932	823.9342	806.3604	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1369.9018	1309.2310	1206.9735	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	297.0062	361.0609	298.0562	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												956.1232	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	74.2515	90.2652	74.5140	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												239.0308	(107)
Space cooling per m2												1.9308	(108)
Energy for space heating												46.1052	(99)
Energy for space cooling												1.9308	(108)
Total												48.0360	(109)
Dwelling Fabric Energy Efficiency (DFEE)												48.0	(109)

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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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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) = 0.1273 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3773 (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) =	0.3773 (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	0.4810	0.4716	0.4622	0.4150	0.4056	0.3584	0.3584	0.3490	0.3773	0.4056	0.4244	0.4433 (22b)
Effective ac	0.6157	0.6112	0.6068	0.5861	0.5822	0.5642	0.5642	0.5609	0.5712	0.5822	0.5901	0.5983 (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)			18.8600	1.3258	25.0038		(27)
150mm EPS B&B			62.6000	0.1300	8.1380		(28a)
140mm Timber Frame	164.4200	20.9800	143.4400	0.1800	25.8192		(29a)
400mm Mineral Wool	61.2000		61.2000	0.1300	7.9560		(30)
Bay Plane	1.4000		1.4000	0.1300	0.1820		(31)
Total net area of external elements Aum(A, m ²)			289.6200				(32)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	69.2190	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.4572 (36)
Total fabric heat loss						(33) + (36) =	81.6762 (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	63.8532	63.3873	62.9306	60.7855	60.3842	58.5159	58.5159	58.1699	59.2355	60.3842	61.1961	62.0449 (38)
Heat transfer coeff	145.5294	145.0635	144.6068	142.4617	142.0603	140.1920	140.1920	139.8461	140.9117	142.0603	142.8723	143.7211 (39)
Average = Sum(39)m / 12 =												142.4598 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1755	1.1718	1.1681	1.1507	1.1475	1.1324	1.1324	1.1296	1.1382	1.1475	1.1541	1.1609 (40)
HLP (average)												1.1507 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum(45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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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	35.5400	31.0835	32.0754	27.9641	26.8322	23.1542	21.4558	24.6208	24.9148	29.0358	31.6949	34.4186 (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	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	143.8438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	27.2494	24.2027	19.6829	14.9012	11.1389	9.4039	10.1612	13.2080	17.7277	22.5094	26.2718	28.0067	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.0811	293.0912	285.5058	269.3573	248.9727	229.8141	217.0149	214.0048	221.5902	237.7387	258.1233	277.2820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	37.3844	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	47.7688	46.2552	43.1121	38.8391	36.0648	32.1586	28.8384	33.0925	34.6039	39.0267	44.0207	46.2616	(72)
Total internal gains	431.2525	429.7023	414.4540	389.2507	362.3296	337.5297	322.1677	326.4584	340.0750	365.4279	394.5689	417.7034	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.9600	10.6334	0.6300	0.7000	0.7700	6.3694 (74)
East	8.7700	19.6403	0.6300	0.7000	0.7700	52.6403 (76)
South	1.9600	46.7521	0.6300	0.7000	0.7700	28.0046 (78)
West	6.1700	19.6403	0.6300	0.7000	0.7700	37.0343 (80)

Solar gains	124.0486	233.4592	368.0027	520.5917	629.9280	642.7214	612.6716	530.5971	421.8963	272.1122	152.8662	103.2525	(83)
Total gains	555.3011	663.1615	782.4567	909.8424	992.2576	980.2511	934.8393	857.0555	761.9713	637.5401	547.4351	520.9559	(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	59.0755	59.2652	59.4524	60.3476	60.5181	61.3246	61.3246	61.4763	61.0114	60.5181	60.1742	59.8188	
alpha	4.9384	4.9510	4.9635	5.0232	5.0345	5.0883	5.0883	5.0984	5.0674	5.0345	5.0116	4.9879	
util living area	0.9995	0.9986	0.9953	0.9805	0.9284	0.7967	0.6304	0.6981	0.9185	0.9917	0.9989	0.9996	(86)
MIT	19.5839	19.7356	20.0034	20.3692	20.6964	20.9115	20.9791	20.9658	20.7929	20.3585	19.9091	19.5662	(87)
Th 2	19.9396	19.9427	19.9456	19.9596	19.9622	19.9745	19.9745	19.9767	19.9697	19.9622	19.9569	19.9514	(88)
util rest of house	0.9993	0.9981	0.9935	0.9722	0.8958	0.7103	0.4981	0.5674	0.8675	0.9870	0.9984	0.9995	(89)
MIT 2	18.6400	18.7939	19.0632	19.4355	19.7460	19.9309	19.9688	19.9661	19.8434	19.4304	18.9788	18.6317	(90)
Living area fraction									fLA = Living area / (4) =			0.1551	(91)
MIT	18.7864	18.9400	19.2090	19.5803	19.8934	20.0830	20.1255	20.1212	19.9907	19.5743	19.1231	18.7766	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7864	18.9400	19.2090	19.5803	19.8934	20.0830	20.1255	20.1212	19.9907	19.5743	19.1231	18.7766	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9990	0.9974	0.9917	0.9682	0.8932	0.7206	0.5188	0.5875	0.8688	0.9845	0.9978	0.9993	(94)
Ext temp.	554.7379	661.4300	775.9319	880.8991	886.2589	706.3399	484.9584	503.5246	661.9696	627.6577	546.2240	520.5773	(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	2108.1978	2036.6887	1837.8145	1521.5290	1163.9618	768.6707	494.2457	520.3912	830.0667	1274.8975	1717.7611	2094.9663	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1155.7742	924.1738	790.0406	461.2535	206.6110	0.0000	0.0000	0.0000	0.0000	481.5464	843.5067	1171.3455	(98)
										(98) / (4) =		6034.2517	(98)
												48.7419	(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	1317.8052	1037.4211	1062.8301	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8174	0.8920	0.8566	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1077.1149	925.3748	910.3726	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1262.5829	1206.9296	1118.3766	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													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	133.5369	209.4768	154.7550	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												497.7687 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	33.3842	52.3692	38.6888	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												124.4422 (107)
Energy for space heating												1.0052 (108)
Energy for space cooling												48.7419 (99)
Total												1.0052 (108)
Target Fabric Energy Efficiency (TFEE)												49.7471 (109)
												57.2 (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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)	
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)	
Number of intermittent fans											0 * 10 =	0.0000 (7a)	
Number of passive vents											0 * 10 =	0.0000 (7b)	
Number of flueless gas fires											0 * 40 =	0.0000 (7c)	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											Air changes per hour		
Pressure test											0.0000 / (5) =		0.0000 (8)
Measured/design AP50											Yes		
Infiltration rate													4.4900
Number of sides sheltered													0.2245 (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) =		0.2245 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind factor	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)	
Adj infilt rate	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)	
	0.2470	0.2301	0.2301	0.2189	0.2189	0.2077	0.2077	0.1964	0.1964	0.2133	0.2077	0.2189 (22b)	
Mechanical extract ventilation - decentralised													
If mechanical ventilation:													0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)	

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.2934		(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) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.8546	Feb 51.8546	Mar 51.8546	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 51.8546 (38)
Heat transfer coeff	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021 (39)
Average = Sum(39)m / 12 =												141.3021 (39)
HLP	Jan 1.1414	Feb 1.1414	Mar 1.1414	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1414 (40)
HLP (average)												1.1414 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy content (annual)	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (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	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381 (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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Water heating gains (Table 5)	121.3575	118.9892	114.0711	107.3850	103.0442	96.9321	91.7369	98.3933	100.7583	107.6786	115.4928	118.9991 (72)
Total internal gains	738.1135	732.6211	705.0822	662.3396	618.1681	579.1235	556.7185	566.4990	591.4849	634.4617	682.1066	718.5453 (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					1.9600	13.4839	0.7200	0.7000	0.7700			9.2307 (74)
East					4.2600	25.1925	0.7200	0.7000	0.7700			37.4839 (76)
South					1.9600	56.7559	0.7200	0.7000	0.7700			38.8535 (78)
West					6.1700	25.1925	0.7200	0.7000	0.7700			54.2901 (80)
East					4.5100	25.1925	0.7200	0.7000	0.7700			39.6837 (76)
Solar gains	179.5420	287.9006	457.6668	650.9456	744.2990	832.3851	765.6039	692.3236	549.9568	357.5709	220.6170	141.4031 (83)
Total gains	917.6556	1020.5218	1162.7490	1313.2852	1362.4671	1411.5086	1322.3225	1258.8226	1141.4418	992.0325	902.7236	859.9484 (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	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594
alpha	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106
util living area	0.9257	0.9041	0.8530	0.7637	0.6337	0.4556	0.3336	0.3484	0.5768	0.7885	0.8936	0.9335 (86)
MIT	18.8712	19.0972	19.5834	20.1336	20.6026	20.8781	20.9604	20.9564	20.7689	20.2308	19.4701	18.8200 (87)
Th 2	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672 (88)
util rest of house	0.9156	0.8913	0.8331	0.7311	0.5803	0.3781	0.2362	0.2474	0.5009	0.7500	0.8767	0.9242 (89)
MIT 2	17.1638	17.4860	18.1748	18.9356	19.5537	19.8729	19.9487	19.9467	19.7653	19.0887	18.0271	17.0918 (90)
Living area fraction												
MIT	17.4286	17.7359	18.3933	19.1214	19.7163	20.0288	20.1056	20.1033	19.9210	19.2659	18.2509	17.3598 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2786	17.5859	18.2433	18.9714	19.5663	19.8788	19.9556	19.9533	19.7710	19.1159	18.1009	17.2098 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8788	0.8515	0.7911	0.6942	0.5573	0.3711	0.2351	0.2460	0.4850	0.7115	0.8357	0.8889 (94)
Useful gains	806.4448	868.9633	919.9071	911.6912	759.3181	523.7741	310.8276	309.6620	553.5830	705.8745	754.4378	764.4283 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	1678.4711	1651.2414	1503.9186	1267.6756	913.7069	562.2133	318.7246	318.3958	631.7596	1005.4854	1370.7548	1654.6216	(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	648.7875	525.6909	434.5045	256.3087	114.8652	0.0000	0.0000	0.0000	0.0000	222.9105	443.7482	662.3038	(98)
RHI space heating demand												3309.1195	(98)
												3309	(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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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	(8)
Measured/design AP50												4.4900
Infiltration rate												0.2245 (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) =	0.2245 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2862	0.2806	0.2750	0.2470	0.2413	0.2133	0.2133	0.2077	0.2245	0.2413	0.2526	0.2638 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5362	0.5306	0.5250	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5026	0.5138 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(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) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.6127	Feb 55.0306	Mar 54.4486	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 52.1203	Dec 53.2844 (38)
Heat transfer coeff	145.0602	144.4781	143.8961	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.5678	142.7319 (39)
Average = Sum(39)m / 12 =												142.2374 (39)
HLP	Jan 1.1717	Feb 1.1670	Mar 1.1623	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1435	Dec 1.1529 (40)
HLP (average)												1.1489 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
								Total per year (kWh/year) = Sum (64)m =				2123.5464 (64)
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (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	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381 (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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Water heating gains (Table 5)	121.3575	118.9892	114.0711	107.3850	103.0442	96.9321	91.7369	98.3933	100.7583	107.6786	115.4928	118.9991 (72)
Total internal gains	738.1135	732.6211	705.0822	662.3396	618.1681	579.1235	556.7185	566.4990	591.4849	634.4617	682.1066	718.5453 (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					1.9600	10.6334	0.7200	0.7000			0.7700			7.2793 (74)
East					4.2600	19.6403	0.7200	0.7000			0.7700			29.2227 (76)
South					1.9600	46.7521	0.7200	0.7000			0.7700			32.0052 (78)
West					6.1700	19.6403	0.7200	0.7000			0.7700			42.3249 (80)
East					4.5100	19.6403	0.7200	0.7000			0.7700			30.9377 (76)
Solar gains	141.7699	266.8105	420.5745	594.9619	719.9178	734.5387	700.1961	606.3967	482.1672	310.9853	174.7042	118.0028	(83)	
Total gains	879.8834	999.4316	1125.6567	1257.3015	1338.0858	1313.6623	1256.9146	1172.8957	1073.6521	945.4470	856.8108	836.5481	(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	20.6112	20.6942	20.7780	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1197	20.9474
alpha	2.3741	2.3796	2.3852	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4080	2.3965
util living area	0.9405	0.9189	0.8794	0.8058	0.7004	0.5673	0.4443	0.4855	0.6720	0.8417	0.9190	0.9463 (86)
MIT	18.5224	18.8094	19.2905	19.9054	20.4077	20.7501	20.9005	20.8734	20.6018	19.9413	19.1468	18.4871 (87)
Th 2	19.9427	19.9465	19.9503	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9654	19.9578 (88)
util rest of house	0.9327	0.9083	0.8633	0.7793	0.6575	0.5006	0.3551	0.3959	0.6112	0.8140	0.9067	0.9392 (89)
MIT 2	16.6470	17.0609	17.7500	18.6232	19.3034	19.7354	19.8993	19.8757	19.5694	18.6923	17.5638	16.6046 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	16.9379	17.3320	17.9889	18.8220	19.4747	19.8927	20.0546	20.0304	19.7295	18.8860	17.8093	16.8966 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.7879	17.1820	17.8389	18.6720	19.3247	19.7427	19.9046	19.8804	19.5795	18.7360	17.6593	16.7466 (93)

8. Space heating requirement

Utilisation	0.8985	0.8699	0.8212	0.7391	0.6271	0.4848	0.3493	0.3877	0.5851	0.7722	0.8685	0.9070 (94)
Useful gains	790.5867	869.3872	924.3589	929.3052	839.0924	636.8412	439.0175	454.7411	628.1857	730.1091	744.1687	758.7496 (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	1811.4923	1774.4858	1631.6297	1380.8075	1077.3847	726.6798	466.9418	491.7901	774.2708	1149.6288	1494.8579	1790.7942 (97)

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Month fraction	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	759.5538	608.2262	526.2094	325.0816	177.2894	0.0000	0.0000	0.0000	0.0000	312.1226	540.4962	767.8411 (98)
Space heating												4016.8205 (98)
Space heating per m2										(98) / (4) =		32.4460 (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												4433.5767 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	759.5538	608.2262	526.2094	325.0816	177.2894	0.0000	0.0000	0.0000	0.0000	312.1226	540.4962	767.8411 (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)	838.3596	671.3314	580.8051	358.8098	195.6837	0.0000	0.0000	0.0000	0.0000	344.5062	596.5742	847.5068 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Efficiency of water heater (217)m	88.0406	87.8513	87.4422	86.5652	85.0322	79.9000	79.9000	79.9000	79.9000	86.3696	87.5378	79.9000 (216)
Fuel for water heating, kWh/month	239.2049	211.0733	222.1964	200.4822	199.4770	188.8772	180.6241	199.2653	199.2469	208.3947	218.3107	233.0259 (219)
Water heating fuel used												2500.1787 (219)
Annual totals kWh/year												
Space heating fuel - main system												4433.5767 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.9666 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.9666 (231)
Electricity for lighting (calculated in Appendix L)												481.2328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1068 * 1.00) =										-845.9118		-845.9118 (233)
Total delivered energy for all uses												6732.0429 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4433.5767	3.4800	154.2885 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	2500.1787	3.4800	87.0062 (247)	
Mechanical ventilation fans	87.9666	13.1900	11.6028 (249)	
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)	
Energy for lighting	481.2328	13.1900	63.4746 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-845.9118	13.1900	-111.5758 (252)	
Total energy cost			334.6888 (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] =	0.8328 (257)
SAP value			88.3830
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	4433.5767	0.2160	957.6526 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	2500.1787	0.2160	540.0386 (264)	
Space and water heating			1497.6912 (265)	
Pumps and fans	162.9666	0.5190	84.5796 (267)	
Energy for lighting	481.2328	0.5190	249.7598 (268)	

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Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total kg/year			1393.0024 (272)
CO2 emissions per m2			11.2500 (273)
EI value			88.9418
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	$3.48 / 0.8471 = 4.108$, stars = 4
Water heating environmental impact	$0.216 / 0.8471 = 0.2550$, 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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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												4.4900
Infiltration rate												0.2245 (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) =	0.2245 (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												
	0.2470	0.2301	0.2301	0.2189	0.2189	0.2077	0.2077	0.1964	0.1964	0.2133	0.2077	0.2189 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		73.2934		(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) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.8546	Feb 51.8546	Mar 51.8546	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 51.8546 (38)
Heat transfer coeff	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021 (39)
Average = Sum(39)m / 12 =												141.3021 (39)
HLP	Jan 1.1414	Feb 1.1414	Mar 1.1414	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1414 (40)
HLP (average)												1.1414 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Calculation Type: New Build (As Built)

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

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Heat gains from water heating, kWh/month	90.2900	79.9607	84.8689	77.3172	76.6649	69.7911	68.2523	73.2046	72.5460	80.1129	83.1548	88.5353 (65)
Total per year (kWh/year) = Sum (64)m =												2123.5464 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381 (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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751 (71)
Water heating gains (Table 5)	121.3575	118.9892	114.0711	107.3850	103.0442	96.9321	91.7369	98.3933	100.7583	107.6786	115.4928	118.9991 (72)
Total internal gains	738.1135	732.6211	705.0822	662.3396	618.1681	579.1235	556.7185	566.4990	591.4849	634.4617	682.1066	718.5453 (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				1.9600	13.4839		0.7200		0.7000		0.7700		9.2307 (74)
East				4.2600	25.1925		0.7200		0.7000		0.7700		37.4839 (76)
South				1.9600	56.7559		0.7200		0.7000		0.7700		38.8535 (78)
West				6.1700	25.1925		0.7200		0.7000		0.7700		54.2901 (80)
East				4.5100	25.1925		0.7200		0.7000		0.7700		39.6837 (76)
Solar gains	179.5420	287.9006	457.6668	650.9456	744.2990	832.3851	765.6039	692.3236	549.9568	357.5709	220.6170	141.4031	(83)
Total gains	917.6556	1020.5218	1162.7490	1313.2852	1362.4671	1411.5086	1322.3225	1258.8226	1141.4418	992.0325	902.7236	859.9484	(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	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594
alpha	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106
util living area	0.9257	0.9041	0.8530	0.7637	0.6337	0.4556	0.3336	0.3484	0.5768	0.7885	0.8936	0.9335 (86)
MIT	18.8712	19.0972	19.5834	20.1336	20.6026	20.8781	20.9604	20.9564	20.7689	20.2308	19.4701	18.8200 (87)
Th 2	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672 (88)
util rest of house	0.9156	0.8913	0.8331	0.7311	0.5803	0.3781	0.2362	0.2474	0.5009	0.7500	0.8767	0.9242 (89)
MIT 2	17.1638	17.4860	18.1748	18.9356	19.5537	19.8729	19.9487	19.9467	19.7653	19.0887	18.0271	17.0918 (90)
Living area fraction									fLA = Living area / (4) =			0.1551 (91)
MIT	17.4286	17.7359	18.3933	19.1214	19.7163	20.0288	20.1056	20.1033	19.9210	19.2659	18.2509	17.3598 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2786	17.5859	18.2433	18.9714	19.5663	19.8788	19.9556	19.9533	19.7710	19.1159	18.1009	17.2098 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	806.4448	868.9633	919.9071	911.6912	759.3181	523.7741	310.8276	309.6620	553.5830	705.8745	754.4378	764.4283 (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	1678.4711	1651.2414	1503.9186	1267.6756	913.7069	562.2133	318.7246	318.3958	631.7596	1005.4854	1370.7548	1654.6216 (97)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Month fraction	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	648.7875	525.6909	434.5045	256.3087	114.8652	0.0000	0.0000	0.0000	0.0000	222.9105	443.7482	662.3038 (98)
Space heating												3309.1195 (98)
Space heating per m2										(98) / (4) =		26.7296 (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												3652.4497 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	648.7875	525.6909	434.5045	256.3087	114.8652	0.0000	0.0000	0.0000	0.0000	222.9105	443.7482	662.3038 (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)	716.1010	580.2328	479.5856	282.9015	126.7828	0.0000	0.0000	0.0000	0.0000	246.0381	489.7883	731.0197 (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	210.5975	185.4306	194.2935	173.5479	169.6198	150.9129	144.3186	159.2129	159.1983	179.9897	191.1044	205.3203 (64)
Efficiency of water heater	87.7212	87.5430	87.0000	85.9528	83.9008	79.9000	79.9000	79.9000	79.9000	85.4858	87.0893	79.9000 (216)
Fuel for water heating, kWh/month	240.0759	211.8166	223.3259	201.9107	202.1669	188.8772	180.6241	199.2653	199.2469	210.5493	219.4352	233.8048 (219)
Water heating fuel used												2511.0986 (219)
Annual totals kWh/year												
Space heating fuel - main system												3652.4497 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												87.9666 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												162.9666 (231)
Electricity for lighting (calculated in Appendix L)												481.2328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.99 * 1179 * 1.00) =										-933.8290		-933.8290 (233)
Total delivered energy for all uses												5873.9188 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3652.4497	10.2300	373.6456 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2511.0986	10.2300	256.8854 (247)
Mechanical ventilation fans	87.9666	36.7200	32.3013 (249)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	481.2328	36.7200	176.7087 (250)
Additional standing charges			103.0000 (251)
Energy saving/generation technologies			
PV Unit	-933.8290	36.7200	-342.9020 (252)
Total energy cost			627.1790 (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	3652.4497	0.2160	788.9291 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2511.0986	0.2160	542.3973 (264)
Space and water heating			1331.3264 (265)
Pumps and fans	162.9666	0.5190	84.5796 (267)
Energy for lighting	481.2328	0.5190	249.7598 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	0.5190	-484.6572 (269)
Total kg/year			1181.0087 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating - main system 1	3652.4497	1.2200	4455.9887 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2511.0986	1.2200	3063.5403 (264)
Space and water heating			7519.5290 (265)
Pumps and fans	162.9666	3.0700	500.3073 (267)
Energy for lighting	481.2328	3.0700	1477.3848 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	3.0700	-2866.8549 (269)
Primary energy kWh/year			6630.3662 (272)
Primary energy kWh/m2/year			53.5571 (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	-£ 119	-264 kg (22.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£119 2.13 kg/m²	B 90	B 91
Total Savings	£119 2.13 kg/m²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£237	£255	-£18
Mains gas	£734	£596	£137
Space heating	£536	£539	-£2
Water heating	£257	£136	£121
Lighting	£177	£177	£0
Generated (PV)	-£343	-£343	£0
Total cost of fuels	£628	£508	£119
Total cost of uses	£627	£509	£119
Delivered energy	47 kWh/m²	37 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.9 tonnes	0.3 tonnes
CO2 emissions per m²	10 kg/m²	7 kg/m²	2 kg/m²
Primary energy	54 kWh/m²	42 kWh/m²	12 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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	(8)
Measured/design AP50												4.4900
Infiltration rate												0.2245 (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) =	0.2245 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2862	0.2806	0.2750	0.2470	0.2413	0.2133	0.2133	0.2077	0.2245	0.2413	0.2526	0.2638 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5362	0.5306	0.5250	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5026	0.5138 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(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) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 55.6127	Feb 55.0306	Mar 54.4486	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 52.1203	Dec 53.2844 (38)
Heat transfer coeff	145.0602	144.4781	143.8961	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.5678	142.7319 (39)
Average = Sum(39)m / 12 =												142.2374 (39)
HLP	Jan 1.1717	Feb 1.1670	Mar 1.1623	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1435	Dec 1.1529 (40)
HLP (average)												1.1489 (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											
2.8769 (42)											
Average daily hot water use (litres/day)											
102.5258 (43)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (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	203.6039	179.1137	185.9041	160.0262	149.8318	131.5381	124.2981	140.1228	147.0274	171.6003	184.3364	198.3266 (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												1.1243 (H8)
Utilisation factor												0.5891 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5258 (H14)
Volume ratio Veff/V												1.0680 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-939.4680 (H17)
Solar input	-27.2427	-45.4602	-77.4240	-103.7634	-128.1909	-126.0321	-124.3665	-108.6597	-85.1023	-58.1149	-32.3138	-22.7975 (63)
Solar input (sum of months) = Sum (63)m =												-939.4680 (63)
Output from w/h	176.3612	133.6535	108.4801	56.2628	21.6409	5.5060	0.0000	31.4632	61.9251	113.4854	152.0226	175.5292 (64)
Total per year (kWh/year) = Sum (64)m =												1036.3299 (64)
Heat gains from water heating, kWh/month	84.6951	74.9073	78.1574	66.4999	60.8345	54.2913	52.2358	57.9325	62.8093	73.4014	77.7404	82.9404 (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	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	113.8375	111.4691	105.0503	92.3610	81.7668	75.4045	70.2094	77.8663	87.2351	98.6577	107.9727	111.4790	(72)
Total internal gains	730.5935	725.1011	696.0613	647.3156	596.8907	557.5960	535.1910	545.9720	577.9617	625.4408	674.5865	711.0252	(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					1.9600	10.6334		0.7200	0.7000	0.7700		7.2793 (74)
East					4.2600	19.6403		0.7200	0.7000	0.7700		29.2227 (76)
South					1.9600	46.7521		0.7200	0.7000	0.7700		32.0052 (78)
West					6.1700	19.6403		0.7200	0.7000	0.7700		42.3249 (80)
East					4.5100	19.6403		0.7200	0.7000	0.7700		30.9377 (76)

Solar gains	141.7699	266.8105	420.5745	594.9619	719.9178	734.5387	700.1961	606.3967	482.1672	310.9853	174.7042	118.0028 (83)
Total gains	872.3634	991.9116	1116.6359	1242.2775	1316.8084	1292.1348	1235.3871	1152.3687	1060.1289	936.4262	849.2907	829.0280 (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	20.6112	20.6942	20.7780	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1197	20.9474
alpha	2.3741	2.3796	2.3852	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4080	2.3965
util living area	0.9415	0.9200	0.8810	0.8092	0.7061	0.5736	0.4504	0.4920	0.6767	0.8440	0.9203	0.9472 (86)
MIT	18.5127	18.8004	19.2810	19.8931	20.3961	20.7437	20.8974	20.8695	20.5952	19.9329	19.1377	18.4772 (87)
Th 2	19.9427	19.9465	19.9503	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9654	19.9578 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9337	0.9096	0.8651	0.7830	0.6634	0.5068	0.3604	0.4018	0.6160	0.8167	0.9082	0.9402 (89)
Living area fraction	16.6332	17.0481	17.7368	18.6068	19.2892	19.7289	19.8970	19.8726	19.5622	18.6811	17.5510	16.5904 (90)
MIT	16.9247	17.3198	17.9763	18.8063	19.4609	19.8863	20.0521	20.0272	fLA = Living area / (4) =			0.1551 (91)
Temperature adjustment									19.7224	18.8752	17.7971	16.8830 (92)
adjusted MIT	16.7747	17.1698	17.8263	18.6563	19.3109	19.7363	19.9021	19.8772	19.5724	18.7252	17.6471	-0.1500
												16.7330 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8998	0.8713	0.8230	0.7426	0.6325	0.4904	0.3544	0.3932	0.5894	0.7748	0.8702	0.9083 (94)	
Useful gains	784.9921	864.2429	919.0302	922.5311	832.8299	633.7007	437.7881	453.1503	624.8841	725.5632	739.0555	753.0241 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W													
Month fracti	1809.5822	1772.7234	1629.8111	1378.5792	1075.4374	725.7721	466.6000	491.3425	773.2614	1148.1104	1493.1268	1788.8638 (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	762.2950	610.4989	528.8210	328.3546	180.5000	0.0000	0.0000	0.0000	0.0000	314.3751	542.9313	770.6647 (98)	
Space heating per m2												4038.4406 (98)	
												(98) / (4) =	32.6207 (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	4457.4399 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	762.2950	610.4989	528.8210	328.3546	180.5000	0.0000	0.0000	0.0000	0.0000	314.3751	542.9313	770.6647 (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)	841.3852	673.8398	583.6876	362.4223	199.2274	0.0000	0.0000	0.0000	0.0000	346.9924	599.2619	850.6233 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating requirement													
Water heating requirement	176.3612	133.6535	108.4801	56.2628	21.6409	5.5060	0.0000	31.4632	61.9251	113.4854	152.0226	175.5292 (64)	
Efficiency of water heater (217)m	88.3763	88.4720	88.5808	88.8593	89.3194	79.9000	79.9000	79.9000	79.9000	87.4923	88.0214	79.9000 (216)	
Fuel for water heating, kWh/month	199.5570	151.0686	122.4646	63.3168	24.2286	6.8911	0.0000	39.3782	77.5032	129.7091	172.7109	198.5539 (219)	
Water heating fuel used												1185.3821 (219)	
Annual totals kWh/year													
Space heating fuel - main system												4457.4399 (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)	87.9666 (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	212.9666 (231)
Electricity for lighting (calculated in Appendix L)	481.2328 (232)

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

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

Total delivered energy for all uses	-845.9118	-845.9118 (233)	5491.1095 (238)
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10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4457.4399	3.4800	155.1189 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1185.3821	3.4800	41.2513 (247)	
Mechanical ventilation fans	87.9666	13.1900	11.6028 (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	481.2328	13.1900	63.4746 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-845.9118	13.1900	-111.5758 (252)	
Total energy cost			296.3593 (255)	

11a. SAP rating - Individual heating systems

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.7374 (257)
SAP value		89.7135
SAP rating (Section 12)		90 (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	4457.4399	0.2160	962.8070 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1185.3821	0.2160	256.0425 (264)
Space and water heating			1218.8495 (265)
Pumps and fans	212.9666	0.5190	110.5296 (267)
Energy for lighting	481.2328	0.5190	249.7598 (268)
Energy saving/generation technologies			
PV Unit	-845.9118	0.5190	-439.0282 (269)
Total kg/year			1140.1108 (272)
CO2 emissions per m2			9.2100 (273)
EI value			90.9494
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	62.6000 (1b)	x 2.4100 (2b)	= 150.8660 (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)	123.8000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 314.2700 (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												4.4900
Infiltration rate												0.2245 (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) =	0.2245 (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												
	0.2470	0.2301	0.2301	0.2189	0.2189	0.2077	0.2077	0.1964	0.1964	0.2133	0.2077	0.2189 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			14.3500	1.3258	19.0246		(27)					
French Door (Uw = 1.40)			4.5100	1.3258	5.9792		(27)					
150mm EPS B&B			62.6000	0.1800	11.2680	75.0000	4695.0000 (28a)					
140mm Timber Frame	164.4200	20.9800	143.4400	0.1900	27.2536	9.0000	1290.9600 (29a)					
400mm Mineral Wool	61.2000		61.2000	0.1100	6.7320	9.0000	550.8000 (30)					
Bay Plane	1.4000		1.4000	0.2000	0.2800	9.0000	12.6000 (30)					
Total net area of external elements Aum(A, m2)			289.6200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	73.2934		(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) =		10763.5200 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							86.9428 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.1541 (36)					
Total fabric heat loss						(33) + (36) =	89.4475 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.8546	Feb 51.8546	Mar 51.8546	Apr 51.8546	May 51.8546	Jun 51.8546	Jul 51.8546	Aug 51.8546	Sep 51.8546	Oct 51.8546	Nov 51.8546	Dec 51.8546 (38)
Heat transfer coeff	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021	141.3021 (39)
Average = Sum(39)m / 12 =												141.3021 (39)
HLP	Jan 1.1414	Feb 1.1414	Mar 1.1414	Apr 1.1414	May 1.1414	Jun 1.1414	Jul 1.1414	Aug 1.1414	Sep 1.1414	Oct 1.1414	Nov 1.1414	Dec 1.1414 (40)
HLP (average)												1.1414 (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												2.8769 (42)
Average daily hot water use (litres/day)												102.5258 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	112.7784	108.6774	104.5763	100.4753	96.3743	92.2732	92.2732	96.3743	100.4753	104.5763	108.6774	112.7784 (44)
Energy conte	167.2471	146.2754	150.9431	131.5959	126.2694	108.9609	100.9682	115.8625	117.2463	136.6393	149.1524	161.9699 (45)
Energy content (annual)										Total = Sum (45)m =		1613.1304 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0871	21.9413	22.6415	19.7394	18.9404	16.3441	15.1452	17.3794	17.5869	20.4959	22.3729	24.2955 (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	203.6039	179.1137	185.9041	160.0262	149.8318	131.5381	124.2981	140.1228	147.0274	171.6003	184.3364	198.3266 (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												1.2504 (H8)
Utilisation factor												0.5506 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												109.5000 (H13)
Daily hot water demand												102.5258 (H14)
Volume ratio Veff/V												1.0680 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-976.4479 (H17)
Solar input	-32.0546	-45.5797	-78.3405	-105.6994	-123.5357	-133.1938	-126.7901	-115.5609	-90.2994	-62.0997	-37.9122	-25.3820 (63)
Solar input (sum of months) = Sum (63)m =												-976.4479 (63)
Output from w/h	171.5492	133.5341	107.5636	54.3268	26.2960	0.0000	0.0000	24.5620	56.7280	109.5006	146.4242	172.9446 (64)
Total per year (kWh/year) = Sum (64)m =												1003.4292 (64)
Heat gains from water heating, kWh/month	84.6951	74.9073	78.1574	66.4999	60.8345	54.2913	52.2358	57.9325	62.8093	73.4014	77.7404	82.9404 (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	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	172.6126	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	68.1235	60.5067	49.2073	37.2531	27.8471	23.5097	25.4031	33.0199	44.3192	56.2735	65.6794	70.0169	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	432.9569	437.4496	426.1281	402.0258	371.6011	343.0061	323.9029	319.4101	330.7317	354.8339	385.2587	413.8537	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	55.1381	(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)	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	-115.0751	(71)
Water heating gains (Table 5)	113.8375	111.4691	105.0503	92.3610	81.7668	75.4045	70.2094	77.8663	87.2351	98.6577	107.9727	111.4790	(72)
Total internal gains	730.5935	725.1011	696.0613	647.3156	596.8907	557.5960	535.1910	545.9720	577.9617	625.4408	674.5865	711.0252	(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					1.9600	13.4839		0.7200	0.7000		0.7700		9.2307 (74)		
East					4.2600	25.1925		0.7200	0.7000		0.7700		37.4839 (76)		
South					1.9600	56.7559		0.7200	0.7000		0.7700		38.8535 (78)		
West					6.1700	25.1925		0.7200	0.7000		0.7700		54.2901 (80)		
East					4.5100	25.1925		0.7200	0.7000		0.7700		39.6837 (76)		
Solar gains	179.5420	287.9006	457.6668	650.9456	744.2990	832.3851	765.6039	692.3236	549.9568	357.5709	220.6170	141.4031	(83)		
Total gains	910.1355	1013.0017	1153.7282	1298.2611	1341.1897	1389.9811	1300.7950	1238.2956	1127.9185	983.0117	895.2036	852.4283	(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	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	21.1594	
alpha	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	2.4106	
util living area													
	0.9268	0.9053	0.8549	0.7673	0.6396	0.4611	0.3385	0.3534	0.5813	0.7912	0.8952	0.9346 (86)	
MIT	18.8619	19.0885	19.5746	20.1231	20.5939	20.8748	20.9591	20.9550	20.7647	20.2239	19.4617	18.8105 (87)	
Th 2	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672	19.9672 (88)	
util rest of house													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

MIT 2	0.9169	0.8927	0.8351	0.7350	0.5863	0.3831	0.2399	0.2513	0.5054	0.7530	0.8784	0.9254 (89)
Living area fraction	17.1506	17.4739	18.1629	18.9220	19.5438	19.8701	19.9481	19.9460	19.7613	19.0799	18.0155	17.0782 (90)
MIT	17.4160	17.7243	18.3818	19.1083	19.7067	20.0259	20.1049	20.1025	fLA = Living area / (4) =			0.1551 (91)
Temperature adjustment									19.9169	19.2574	18.2398	17.3469 (92)
adjusted MIT	17.2660	17.5743	18.2318	18.9583	19.5567	19.8759	19.9549	19.9525	19.7669	19.1074	18.0898	-0.1500
												17.1969 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8803	0.8530	0.7931	0.6978	0.5628	0.3758	0.2387	0.2497	0.4891	0.7143	0.8376	0.8904 (94)	
Useful gains	801.1765	864.1069	915.0767	905.9317	754.7603	522.3143	310.4505	309.2486	551.6140	702.1908	749.8059	759.0008 (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													
Month fracti	1676.6927	1649.5991	1502.3000	1265.8207	912.3430	561.8096	318.6183	318.2791	631.1870	1004.2841	1369.1878	1652.7929 (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	651.3841	527.8507	436.8942	259.1201	117.2415	0.0000	0.0000	0.0000	0.0000	224.7574	445.9550	664.9813 (98)	
Space heating per m2												3328.1843 (98)	
												(98) / (4) =	26.8836 (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													3673.4926 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	651.3841	527.8507	436.8942	259.1201	117.2415	0.0000	0.0000	0.0000	0.0000	224.7574	445.9550	664.9813 (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)	718.9670	582.6167	482.2231	286.0045	129.4057	0.0000	0.0000	0.0000	0.0000	248.0766	492.2240	733.9750 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating requirement													
Efficiency of water heater (217)m	171.5492	133.5341	107.5636	54.3268	26.2960	0.0000	0.0000	24.5620	56.7280	109.5006	146.4242	172.9446 (64)	
Fuel for water heating, kWh/month	88.1395	88.2148	88.2648	88.5448	88.4305	79.9000	79.9000	79.9000	79.9000	86.7924	87.6971	79.9000 (216)	
Water heating fuel used	194.6339	151.3737	121.8647	61.3551	29.7364	0.0000	0.0000	30.7409	70.9987	126.1638	166.9659	196.1643 (219)	
Annual totals kWh/year												1149.9975 (219)	
Space heating fuel - main system												3673.4926 (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)													87.9666 (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													212.9666 (231)
Electricity for lighting (calculated in Appendix L)													481.2328 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.99 * 1179 * 1.00) =										-933.8290			-933.8290 (233)
Total delivered energy for all uses													4583.8605 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3673.4926	10.2300	375.7983 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1149.9975	10.2300	117.6447 (247)	
Mechanical ventilation fans	87.9666	36.7200	32.3013 (249)	
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)	
Pump for solar water heating	50.0000	36.7200	18.3600 (249)	
Energy for lighting	481.2328	36.7200	176.7087 (250)	
Additional standing charges			103.0000 (251)	
Energy saving/generation technologies				
PV Unit	-933.8290	36.7200	-342.9020 (252)	
Total energy cost			508.4511 (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	3673.4926	0.2160	793.4744 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1149.9975	0.2160	248.3995 (264)
Space and water heating			1041.8739 (265)
Pumps and fans	212.9666	0.5190	110.5296 (267)
Energy for lighting	481.2328	0.5190	249.7598 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	0.5190	-484.6572 (269)
Total kg/year			917.5061 (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	3673.4926	1.2200	4481.6610 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1149.9975	1.2200	1402.9969 (264)
Space and water heating			5884.6579 (265)
Pumps and fans	212.9666	3.0700	653.8073 (267)
Energy for lighting	481.2328	3.0700	1477.3848 (268)
Energy saving/generation technologies			
PV Unit	-933.8290	3.0700	-2866.8549 (269)
Primary energy kWh/year			5148.9951 (272)
Primary energy kWh/m2/year			41.5912 (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	West
Overshading	Average or unknown
Thermal mass parameter	86.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	414.84 (P1)
Transmission heat loss coefficient	89.45 (37)
Summer heat loss coefficient	504.28 (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	1.9600	87.1704	0.7200	0.7000	0.9000	69.7495
East	4.2600	125.2818	0.7200	0.7000	0.9000	217.8779
South	1.9600	118.5567	0.7200	0.7000	0.9000	94.8632
West	6.1700	125.2818	0.7200	0.7000	0.9000	315.5649
East	4.5100	125.2818	0.7200	0.7000	0.9000	230.6641
total:						928.7195

Solar gains	Jun 998	Jul 929	Aug 822	(P3)
Internal gains	576	554	563	
Total summer gains	1574	1482	1386	(P5)
Summer gain/loss ratio	3.12	2.94	2.75	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 86.9)	1.39	1.39	1.39	
Threshold temperature	19.91	21.63	21.44	(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