

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-140			Issued on Date	29/05/2019
Assessment Reference	As Built	Prop Type Ref	404-A - Det (As)		
Property	29, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE				
SAP Rating	87 B	DER	13.79	TER	16.69
Environmental	88 B	% DER<TER	17.39		
CO ₂ Emissions (t/year)	1.36	DFEE	51.38	TFEE	56.44
General Requirements Compliance	Pass	% DFEE<TFEE	8.96		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

Detached House, total floor area 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) 16.69 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.79 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.40 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.37 (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
Potterton Promax Ultra Combi 40 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Medium OK

Based on:

Overshading: Average
Windows facing North: 4.76 m², No overhang
Windows facing East: 12.29 m², No overhang
Windows facing South: 2.84 m², No overhang
Windows facing West: 12.76 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Door U-value 0.90 W/m²K
Photovoltaic array 0.81 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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3533 (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) =	0.3533 (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	0.4504	0.4416	0.4327	0.3886	0.3798	0.3356	0.3356	0.3268	0.3533	0.3798	0.3974	0.4151 (22b)
Effective ac	0.6014	0.5975	0.5936	0.5755	0.5721	0.5563	0.5563	0.5534	0.5624	0.5721	0.5790	0.5861 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (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	58.9112	58.5254	58.1472	56.3710	56.0387	54.4916	54.4916	54.2051	55.0875	56.0387	56.7110	57.4138 (38)
Heat transfer coeff	163.2964	162.9106	162.5325	160.7562	160.4239	158.8768	158.8768	158.5903	159.4727	160.4239	161.0962	161.7990 (39)
Average = Sum(39)m / 12 =												160.7546 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3172	1.3141	1.3111	1.2967	1.2941	1.2816	1.2816	1.2793	1.2864	1.2941	1.2995	1.3051 (40)
HLP (average)												1.2967 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8774 (42)
102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1613.3389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	21.0602 (61)
Total heat required for water heating calculated for each month											
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (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 =	0.0000 (63)										
Output from w/h	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866 (65)
Total per year (kWh/year) = Sum (64)m =	1859.9338 (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	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872 (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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974 (71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718 (72)
Total internal gains	467.1750	464.9175	448.0992	420.6888	392.3539	365.3946	348.0940	354.6592	368.9219	396.5673	428.3807	452.7194 (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	4.7600					10.6334	0.6200	0.7000	0.7700	15.2231 (74)		
East	12.2900					19.6403	0.6200	0.7000	0.7700	72.5976 (76)		
South	2.8400					46.7521	0.6200	0.7000	0.7700	39.9339 (78)		
West	6.9600					19.6403	0.6200	0.7000	0.7700	41.1130 (80)		
West	5.8000					19.6403	0.6200	0.7000	0.7700	34.2609 (80)		
Solar gains	203.1285	383.9571	609.4497	868.8090	1057.1342	1081.1604	1029.5629	887.7120	700.8913	448.6449	250.6180	168.8818 (83)
Total gains	670.3035	848.8746	1057.5489	1289.4978	1449.4881	1446.5551	1377.6569	1242.3712	1069.8132	845.2122	678.9987	621.6012 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	30.7848	30.8577	30.9295	31.2712	31.3360	31.6411	31.6411	31.6983	31.5229	31.3360	31.2052	31.0697
alpha	3.0523	3.0572	3.0620	3.0847	3.0891	3.1094	3.1094	3.1132	3.1015	3.0891	3.0803	3.0713
util living area	0.9896	0.9783	0.9507	0.8834	0.7662	0.6117	0.4751	0.5352	0.7667	0.9356	0.9822	0.9917 (86)
MIT	18.7714	19.0628	19.5384	20.1250	20.5858	20.8562	20.9515	20.9295	20.6951	20.0466	19.2942	18.7232 (87)
Th 2	19.8274	19.8298	19.8322	19.8434	19.8455	19.8553	19.8553	19.8571	19.8515	19.8455	19.8412	19.8368 (88)
util rest of house	0.9873	0.9736	0.9398	0.8575	0.7150	0.5278	0.3641	0.4213	0.6952	0.9158	0.9776	0.9898 (89)
MIT 2	16.8637	17.2880	17.9739	18.8043	19.4153	19.7413	19.8303	19.8174	19.5750	18.7172	17.6345	16.7989 (90)
Living area fraction	17.1318	17.5374	18.1938	18.9899	19.5798	19.8980	19.9879	19.9737	19.7324	18.9040	17.8677	17.0693 (92)
MIT	16.9818	17.3874	18.0438	18.8399	19.4298	19.7480	19.8379	19.8237	19.5824	18.7540	17.7177	16.9193 (93)
Temperature adjustment												-0.1500
adjusted MIT												16.9193 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9782	0.9585	0.9164	0.8293	0.6937	0.5192	0.3623	0.4177	0.6754	0.8897	0.9642	0.9822 (94)
Useful gains	655.6596	813.6715	969.1894	1069.3827	1005.4964	751.1218	499.0888	518.9308	722.5204	751.9763	654.6567	610.5397 (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	2070.8886	2034.3276	1876.2358	1597.9031	1240.0367	817.8973	514.4240	542.9620	874.2927	1308.0896	1710.4786	2057.9667 (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	1052.9304	820.2809	674.8425	380.5347	174.4980	0.0000	0.0000	0.0000	0.0000	413.7483	760.1918	1076.8857 (98)
Space heating												5353.9123 (98)
Space heating per m2												(98) / (4) = 43.1872 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5948.7914 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1052.9304	820.2809	674.8425	380.5347	174.4980	0.0000	0.0000	0.0000	0.0000	413.7483	760.1918	1076.8857	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	1169.9227	911.4232	749.8250	422.8164	193.8867	0.0000	0.0000	0.0000	0.0000	459.7203	844.6576	1196.5397	(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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater (217)m	89.4832	89.4291	89.3096	89.0333	88.4595	86.7000	86.7000	86.7000	86.7000	89.0649	89.3797	89.5050	(216)
Fuel for water heating, kWh/month	210.4882	184.8575	192.5608	170.5941	166.3729	148.9205	140.4217	157.6948	158.5610	176.9588	189.6626	204.5147	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													5948.7914 (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)													457.0496 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895			-588.2895 (233)
Total delivered energy for all uses													7994.1591 (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	5948.7914	0.2160	1284.9390 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2101.6076	0.2160	453.9472 (264)
Space and water heating			1738.8862 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total CO2, kg/year			1709.6977 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.7900 (273)

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

DER			13.7900 ZC1
Total Floor Area		TFA	123.9700
Assumed number of occupants		N	2.8774
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			13.8762 ZC2
CO2 emissions from cooking, equation (L16)			1.5170 ZC3
Total CO2 emissions			29.1831 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			29.1831 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3848 (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) =	0.3848 (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	0.4906	0.4810	0.4713	0.4232	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521 (22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5855	0.5668	0.5668	0.5633	0.5740	0.5855	0.5937	0.6022 (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 Opening Type (Uw = 1.40)			31.0000	1.3258	41.0985		(27)					
Heat Loss Floor 1			62.4900	0.1300	8.1237		(28a)					
100mm Knauf Supafil	158.8600	31.0000	127.8600	0.1800	23.0148		(29a)					
External Roof	60.0500		60.0500	0.1300	7.8065		(30)					
Bay Roof	2.4400		2.4400	0.1300	0.3172		(30)					
Total net area of external elements Aum(A, m2)			283.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.3607		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2327 (36)					
Total fabric heat loss						(33) + (36) =	93.5934 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.7621	60.3044	59.8558	57.7487	57.3544	55.5192	55.5192	55.1793	56.2261	57.3544	58.1520	58.9858 (38)
Heat transfer coeff	154.3555	153.8978	153.4492	151.3420	150.9478	149.1126	149.1126	148.7727	149.8195	150.9478	151.7454	152.5791 (39)
Average = Sum(39)m / 12 =												151.3402 (39)
HLP	Jan 1.2451	Feb 1.2414	Mar 1.2378	Apr 1.2208	May 1.2176	Jun 1.2028	Jul 1.2028	Aug 1.2001	Sep 1.2085	Oct 1.2176	Nov 1.2240	Dec 1.2308 (40)
HLP (average)												1.2208 (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												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	49.1176	45.5105	47.0275	49.1176	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	218.2276	192.3217	201.9215	180.9279	175.4033	154.4854	148.0088	164.9951	166.5765	187.6158	198.4868	212.9497 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	68.3566	60.1497	62.9348	56.0900	54.2694	47.6118	45.3332	50.8087	51.3182	58.1782	61.9284	66.6017 (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	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	91.8771	89.5085	84.5898	77.9028	72.9427	66.1275	60.9317	68.2912	71.2753	78.1964	86.0116	89.5184	(72)
Total internal gains	477.2140	474.9641	458.1618	430.7730	401.8399	374.2041	356.9190	364.1598	379.0275	406.6505	438.4387	462.7660	(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				4.5200	10.6334	0.6300	0.7000	0.7700	14.6887 (74)			
East				11.6600	19.6403	0.6300	0.7000	0.7700	69.9870 (76)			
South				2.7000	46.7521	0.6300	0.7000	0.7700	38.5777 (78)			
West				12.1200	19.6403	0.6300	0.7000	0.7700	72.7481 (80)			
Solar gains	196.0015	370.4714	588.0157	838.2209	1019.8952	1043.0681	993.2912	856.4500	676.2295	432.8789	241.8221	162.9583 (83)
Total gains	673.2156	845.4355	1046.1775	1268.9939	1421.7352	1417.2722	1350.2102	1220.6098	1055.2571	839.5294	680.2607	625.7243 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7740	55.9399	56.1034	56.8846	57.0331	57.7351	57.7351	57.8670	57.4627	57.0331	56.7334	56.4234	
alpha	4.7183	4.7293	4.7402	4.7923	4.8022	4.8490	4.8490	4.8578	4.8308	4.8022	4.7822	4.7616	
util living area	0.9987	0.9959	0.9850	0.9399	0.8224	0.6375	0.4783	0.5453	0.8199	0.9763	0.9970	0.9991	(86)
MIT	19.5811	19.7811	20.1093	20.5224	20.8244	20.9619	20.9922	20.9859	20.8736	20.4386	19.9303	19.5530	(87)
Th 2	19.8841	19.8870	19.8899	19.9034	19.9059	19.9178	19.9178	19.9199	19.9132	19.9059	19.9008	19.8955	(88)
util rest of house	0.9982	0.9945	0.9796	0.9184	0.7661	0.5442	0.3646	0.4250	0.7407	0.9642	0.9957	0.9988	(89)
MIT 2	17.9934	18.2873	18.7651	19.3558	19.7421	19.8940	19.9151	19.9145	19.8151	19.2535	18.5157	17.9602	(90)
Living area fraction	18.2165	18.4972	18.9540	19.5198	19.8942	20.0440	20.0665	20.0651	19.9638	19.4201	18.7145	18.1840	(92)
Temperature adjustment	18.2165	18.4972	18.9540	19.5198	19.8942	20.0440	20.0665	20.0651	19.9638	19.4201	18.7145	18.1840	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	671.2751	838.4651	1018.0710	1153.5542	1088.2682	787.5887	513.8486	539.1902	786.0773	803.1505	675.8403	624.4381	(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	2148.0923	2092.5863	1911.0602	1607.2181	1236.8995	811.7743	516.8919	545.2625	878.5178	1331.3684	1762.4467	2133.6629	(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	1098.7519	842.7695	664.3840	326.6380	110.5817	0.0000	0.0000	0.0000	0.0000	392.9941	782.3566	1122.8632	(98)
Space heating												5341.3390	(98)
Space heating per m2												43.0857	(99)

8c. Space cooling requirement

Not applicable

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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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5718.7784 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1098.7519	842.7695	664.3840	326.6380	110.5817	0.0000	0.0000	0.0000	0.0000	392.9941	782.3566	1122.8632	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	1176.3939	902.3228	711.3319	349.7195	118.3958	0.0000	0.0000	0.0000	0.0000	420.7645	837.6409	1202.2090	(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	218.2276	192.3217	201.9215	180.9279	175.4033	154.4854	148.0088	164.9951	166.5765	187.6158	198.4868	212.9497	(64)
Efficiency of water heater (217)m	88.5544	88.3356	87.8252	86.5208	83.9257	80.3000	80.3000	80.3000	80.3000	86.8693	88.1562	88.6230	(216)
Fuel for water heating, kWh/month	246.4335	217.7171	229.9129	209.1149	208.9984	192.3853	184.3198	205.4734	207.4428	215.9748	225.1536	240.2872	(219)
Water heating fuel used												2583.2136	(219)
Annual totals kWh/year													
Space heating fuel - main system												5718.7784	(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)												457.0496	(232)
Total delivered energy for all uses												8834.0416	(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	5718.7784	0.2160	1235.2561 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2583.2136	0.2160	557.9741 (264)
Space and water heating			1793.2303 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Total CO2, kg/m2/year			2069.3640 (272)
Emissions per m2 for space and water heating			14.4650 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9134 (272b)
Emissions per m2 for pumps and fans			0.3140 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.4650 * 1.00) + 1.9134 + 0.3140, rounded to 2 d.p.			16.6900 (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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3533 (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) =	0.3533 (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	0.4504	0.4416	0.4327	0.3886	0.3798	0.3356	0.3356	0.3268	0.3533	0.3798	0.3974	0.4151 (22b)
	0.6014	0.5975	0.5936	0.5755	0.5721	0.5563	0.5563	0.5534	0.5624	0.5721	0.5790	0.5861 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			9.0000	553.3200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 17544.0300 (34)
141.5184 (35)
11.3514 (36)
(33) + (36) = 104.3852 (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	58.9112	58.5254	58.1472	56.3710	56.0387	54.4916	54.4916	54.2051	55.0875	56.0387	56.7110	57.4138 (38)
Heat transfer coeff	163.2964	162.9106	162.5325	160.7562	160.4239	158.8768	158.8768	158.5903	159.4727	160.4239	161.0962	161.7990 (39)
Average = Sum(39)m / 12 =												160.7546 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3172	1.3141	1.3111	1.2967	1.2941	1.2816	1.2816	1.2793	1.2864	1.2941	1.2995	1.3051 (40)
HLP (average)												1.2967 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8774 (42)
102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (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 = 1613.3389 (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	35.5446	31.0875	32.0796	27.9677	26.8357	23.1572	21.4585	24.6240	24.9181	29.0396	31.6990	34.4231 (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	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	47.7750	46.2612	43.1177	38.8441	36.0695	32.1627	28.8421	33.0967	34.6084	39.0317	44.0264	46.2675	(72)
Total internal gains	430.1119	428.7169	413.6897	388.7143	361.9667	337.2394	321.8294	325.9653	339.3607	364.4858	393.4534	416.5151	(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					4.7600	10.6334	0.6200	0.7000			0.7700			15.2231 (74)
East					12.2900	19.6403	0.6200	0.7000			0.7700			72.5976 (76)
South					2.8400	46.7521	0.6200	0.7000			0.7700			39.9339 (78)
West					6.9600	19.6403	0.6200	0.7000			0.7700			41.1130 (80)
West					5.8000	19.6403	0.6200	0.7000			0.7700			34.2609 (80)
Solar gains	203.1285	383.9571	609.4497	868.8090	1057.1342	1081.1604	1029.5629	887.7120	700.8913	448.6449	250.6180	168.8818	(83)	
Total gains	633.2404	812.6740	1023.1394	1257.5233	1419.1009	1418.3998	1351.3923	1213.6773	1040.2520	813.1307	644.0714	585.3970	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.8435	29.9142	29.9838	30.3151	30.3779	30.6737	30.6737	30.7291	30.5591	30.3779	30.2511	30.1197	
alpha	2.9896	2.9943	2.9989	3.0210	3.0252	3.0449	3.0449	3.0486	3.0373	3.0252	3.0167	3.0080	
util living area	0.9902	0.9791	0.9519	0.8855	0.7700	0.6173	0.4812	0.5429	0.7730	0.9383	0.9833	0.9922	(86)
MIT	18.6857	18.9847	19.4737	20.0786	20.5574	20.8429	20.9458	20.9213	20.6709	19.9960	19.2218	18.6370	(87)
Th 2	19.8274	19.8298	19.8322	19.8434	19.8455	19.8553	19.8553	19.8571	19.8515	19.8455	19.8412	19.8368	(88)
util rest of house	0.9881	0.9747	0.9415	0.8604	0.7198	0.5340	0.3698	0.4289	0.7031	0.9195	0.9790	0.9906	(89)
MIT 2	17.7226	18.0208	18.5035	19.0929	19.5291	19.7691	19.8358	19.8262	19.6451	19.0299	18.2667	17.6808	(90)
Living area fraction	fLA = Living area / (4) =												0.1405 (91)
MIT	17.8579	18.1563	18.6399	19.2314	19.6736	19.9200	19.9918	19.9801	19.7892	19.1657	18.4009	17.8151	(92)
Temperature adjustment													0.0000
adjusted MIT	17.8579	18.1563	18.6399	19.2314	19.6736	19.9200	19.9918	19.9801	19.7892	19.1657	18.4009	17.8151	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	622.4491	784.9537	949.0488	1061.7812	1009.3987	764.6866	518.6753	536.5112	726.8587	735.9057	625.6763	577.3762	(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	2213.9639	2159.5870	1973.1211	1660.8408	1279.1562	845.2193	538.8775	567.7666	907.2782	1374.1385	1820.5359	2202.9132	(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	1184.0870	923.7536	761.9097	431.3230	200.6996	0.0000	0.0000	0.0000	0.0000	474.8452	860.2989	1209.3995	(98)
Space heating													6046.3164 (98)
Space heating per m2	(98) / (4) =												48.7724 (99)

8c. Space cooling requirement

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

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1493.4422	1175.6886	1205.2866	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8134	0.8695	0.8353	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1214.7072	1022.2583	1006.7335	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1774.1352	1693.1867	1534.3795	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	402.7882	499.1707	392.5686	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1294.5275	(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	100.6970	124.7927	98.1422	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												323.6319	(107)
Space cooling per m2												2.6106	(108)
Energy for space heating												48.7724	(99)
Energy for space cooling												2.6106	(108)
Total												51.3830	(109)
Dwelling Fabric Energy Efficiency (DFEE)												51.4	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3848 (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) =	0.3848 (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	0.4906	0.4810	0.4713	0.4232	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521 (22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5855	0.5668	0.5668	0.5633	0.5740	0.5855	0.5937	0.6022 (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 Opening Type (Uw = 1.40)			31.0000	1.3258	41.0985		(27)					
Heat Loss Floor 1			62.4900	0.1300	8.1237		(28a)					
100mm Knauf Supafil	158.8600	31.0000	127.8600	0.1800	23.0148		(29a)					
External Roof	60.0500		60.0500	0.1300	7.8065		(30)					
Bay Roof	2.4400		2.4400	0.1300	0.3172		(30)					
Total net area of external elements Aum(A, m2)			283.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.3607		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2327 (36)					
Total fabric heat loss						(33) + (36) =	93.5934 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.7621	60.3044	59.8558	57.7487	57.3544	55.5192	55.5192	55.1793	56.2261	57.3544	58.1520	58.9858 (38)
Heat transfer coeff	154.3555	153.8978	153.4492	151.3420	150.9478	149.1126	149.1126	148.7727	149.8195	150.9478	151.7454	152.5791 (39)
Average = Sum(39)m / 12 =												151.3402 (39)
HLP	Jan 1.2451	Feb 1.2414	Mar 1.2378	Apr 1.2208	May 1.2176	Jun 1.2028	Jul 1.2028	Aug 1.2001	Sep 1.2085	Oct 1.2176	Nov 1.2240	Dec 1.2308 (40)
HLP (average)												1.2208 (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												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)
Energy content (annual)											Total = Sum(45)m =	1613.3389 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.5446	31.0875	32.0796	27.9677	26.8357	23.1572	21.4585	24.6240	24.9181	29.0396	31.6990	34.4231 (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	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	47.7750	46.2612	43.1177	38.8441	36.0695	32.1627	28.8421	33.0967	34.6084	39.0317	44.0264	46.2675	(72)
Total internal gains	430.1119	428.7169	413.6897	388.7143	361.9667	337.2394	321.8294	325.9653	339.3607	364.4858	393.4534	416.5151	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	4.5200	10.6334	0.6300		0.7000	0.7700	14.6887 (74)
East	11.6600	19.6403	0.6300		0.7000	0.7700	69.9870 (76)
South	2.7000	46.7521	0.6300		0.7000	0.7700	38.5777 (78)
West	12.1200	19.6403	0.6300		0.7000	0.7700	72.7481 (80)

Solar gains	196.0015	370.4714	588.0157	838.2209	1019.8952	1043.0681	993.2912	856.4500	676.2295	432.8789	241.8221	162.9583	(83)
Total gains	626.1135	799.1883	1001.7054	1226.9351	1381.8619	1380.3075	1315.1207	1182.4153	1015.5902	797.3647	635.2755	579.4735	(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	55.7740	55.9399	56.1034	56.8846	57.0331	57.7351	57.7351	57.8670	57.4627	57.0331	56.7334	56.4234	
alpha	4.7183	4.7293	4.7402	4.7923	4.8022	4.8490	4.8490	4.8578	4.8308	4.8022	4.7822	4.7616	
util living area	0.9990	0.9968	0.9874	0.9463	0.8341	0.6511	0.4902	0.5609	0.8358	0.9806	0.9977	0.9993	(86)
MIT	19.5462	19.7473	20.0784	20.4987	20.8120	20.9583	20.9914	20.9842	20.8614	20.4103	19.8971	19.5186	(87)
Th 2	19.8841	19.8870	19.8899	19.9034	19.9059	19.9178	19.9178	19.9199	19.9132	19.9059	19.9008	19.8955	(88)
util rest of house	0.9987	0.9956	0.9827	0.9266	0.7795	0.5572	0.3741	0.4381	0.7593	0.9704	0.9968	0.9991	(89)
MIT 2	18.5584	18.7612	19.0918	19.5082	19.7851	19.8998	19.9157	19.9157	19.8384	19.4338	18.9222	18.5398	(90)
Living area fraction									fLA = Living area / (4) =			0.1405	(91)
MIT	18.6972	18.8998	19.2305	19.6474	19.9294	20.0486	20.0669	20.0659	19.9821	19.5710	19.0592	18.6773	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6972	18.8998	19.2305	19.6474	19.9294	20.0486	20.0669	20.0659	19.9821	19.5710	19.0592	18.6773	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	624.9719	794.5550	980.6692	1129.9304	1078.9712	785.6607	513.5494	538.4572	776.8843	770.3435	632.5412	578.7425	(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	2222.2929	2154.5390	1953.4794	1626.5313	1242.2044	812.4483	516.9542	545.3789	881.2595	1354.1501	1814.7491	2208.9373	(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	1188.4068	913.9092	723.7708	357.5526	121.4455	0.0000	0.0000	0.0000	0.0000	434.3521	851.1897	1212.8649	(98)
Space heating												5803.4916	(98)
Space heating per m2												(98) / (4) =	46.8137 (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	1401.6580	1103.4329	1130.6724	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9033	0.9481	0.9226	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1266.1516	1046.1192	1043.1022	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1729.6117	1650.7912	1497.8395	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	333.6912	449.8760	338.3245	0.0000	0.0000	0.0000	0.0000	(104)

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Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												1121.8917 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	83.4228	112.4690	84.5811	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												280.4729 (107)
Space cooling per m2												2.2624 (108)
Energy for space heating												46.8137 (99)
Energy for space cooling												2.2624 (108)
Total												49.0761 (109)
Target Fabric Energy Efficiency (TFEE)												56.4 (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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3533 (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) =	0.3533 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3709	0.3444	0.3533	0.3356	0.3356	0.3268	0.3179	0.3091	0.3003	0.3268	0.3091	0.3268 (22b)
Effective ac	0.5688	0.5593	0.5624	0.5563	0.5563	0.5534	0.5505	0.5478	0.5451	0.5534	0.5478	0.5534 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (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	55.7140	54.7857	55.0875	54.4916	54.4916	54.2051	53.9263	53.6550	53.3915	54.2051	53.6550	54.2051 (38)
Heat transfer coeff	160.0992	159.1710	159.4727	158.8768	158.8768	158.5903	158.3115	158.0403	157.7767	158.5903	158.0403	158.5903 (39)
Average = Sum(39)m / 12 =												158.7030 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2914	1.2839	1.2864	1.2816	1.2816	1.2793	1.2770	1.2748	1.2727	1.2793	1.2748	1.2793 (40)
HLP (average)												1.2802 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8774 (42)
102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602 (61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (64)
RHI water heating demand	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270 (65)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270 (65)
	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270 (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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(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					4.7600	13.4839	0.6200	0.7000			0.7700			19.3039 (74)
East					12.2900	25.1925	0.6200	0.7000			0.7700			93.1208 (76)
South					2.8400	56.7559	0.6200	0.7000			0.7700			48.4788 (78)
West					6.9600	25.1925	0.6200	0.7000			0.7700			52.7356 (80)
West					5.8000	25.1925	0.6200	0.7000			0.7700			43.9464 (80)
Solar gains	257.5855	414.9309	664.3011	952.0883	1099.9166	1221.3753	1154.2038	1020.6348	806.7417	523.2924	316.9152			210.4169 (83)
Total gains	953.0912	1105.3222	1327.6964	1573.3015	1677.3872	1759.9718	1670.2698	1546.1228	1356.6702	1115.6379	956.4817			886.2370 (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	31.3995	31.5827	31.5229	31.6411	31.6411	31.6983	31.7541	31.8086	31.8617	31.6983	31.8086	31.6983
alpha	3.0933	3.1055	3.1015	3.1094	3.1094	3.1132	3.1169	3.1206	3.1241	3.1132	3.1206	3.1132
util living area	0.9705	0.9541	0.9083	0.8100	0.6695	0.4801	0.3590	0.3847	0.6301	0.8593	0.9496	0.9751 (86)
MIT	19.2033	19.4267	19.8823	20.3975	20.7521	20.9356	20.9806	20.9765	20.8480	20.3852	19.7311	19.1750 (87)
Th 2	19.8475	19.8534	19.8515	19.8553	19.8553	19.8571	19.8589	19.8606	19.8623	19.8571	19.8606	19.8571 (88)
util rest of house	0.9643	0.9448	0.8898	0.7733	0.6079	0.3951	0.2585	0.2783	0.5449	0.8215	0.9373	0.9697 (89)
MIT 2	17.5005	17.8238	18.4675	19.1711	19.6175	19.8134	19.8510	19.8509	19.7418	19.1787	18.2713	17.4662 (90)
Living area fraction	17.7397	18.0490	18.6663	19.3434	19.7770	19.9711	20.0097	20.0091	fLA = Living area / (4) = 19.8972	19.3482	18.4764	17.7063 (91)
MIT	17.7397	18.0490	18.6663	19.3434	19.7770	19.9711	20.0097	20.0091	19.8972	19.3482	18.4764	17.7063 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5897	17.8990	18.5163	19.1934	19.6270	19.8211	19.8597	19.8591	19.7472	19.1982	18.3264	17.5563 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	902.1124	1019.9130	1144.8980	1177.6427	996.9678	690.3855	431.9371	429.9815	726.2928	886.2181	874.2380	845.2111	(94)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	2031.6164	2005.4016	1836.5320	1540.0590	1132.3094	716.9998	436.8925	436.0429	796.3372	1236.7232	1647.7965	1991.3114	(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	840.3510	662.2484	514.5757	260.9397	100.6941	0.0000	0.0000	0.0000	0.0000	260.7758	556.9621	852.6986	(98)
Space heating	840.3510	662.2484	514.5757	260.9397	100.6941	0.0000	0.0000	0.0000	0.0000	260.7758	556.9621	852.6986	(98)
RHI space heating demand	840.3510	662.2484	514.5757	260.9397	100.6941	0.0000	0.0000	0.0000	0.0000	260.7758	556.9621	852.6986	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3533 (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) =	0.3533 (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	0.4504	0.4416	0.4327	0.3886	0.3798	0.3356	0.3356	0.3268	0.3533	0.3798	0.3974	0.4151 (22b)
	0.6014	0.5975	0.5936	0.5755	0.5721	0.5563	0.5563	0.5534	0.5624	0.5721	0.5790	0.5861 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (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	58.9112	58.5254	58.1472	56.3710	56.0387	54.4916	54.4916	54.2051	55.0875	56.0387	56.7110	57.4138 (38)
Heat transfer coeff												
Average = Sum(39)m / 12 =	163.2964	162.9106	162.5325	160.7562	160.4239	158.8768	158.8768	158.5903	159.4727	160.4239	161.0962	161.7990 (39)
												160.7546 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3172	1.3141	1.3111	1.2967	1.2941	1.2816	1.2816	1.2793	1.2864	1.2941	1.2995	1.3051 (40)
HLP (average)												1.2967 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8774 (42)
102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1613.3389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	21.0602 (61)
Total heat required for water heating calculated for each month											
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (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 =	0.0000 (63)										
Output from w/h	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866 (65)
Total per year (kWh/year) = Sum(64)m =	1859.9338 (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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(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				4.7600	10.6334		0.6200		0.7000		0.7700		15.2231 (74)
East				12.2900	19.6403		0.6200		0.7000		0.7700		72.5976 (76)
South				2.8400	46.7521		0.6200		0.7000		0.7700		39.9339 (78)
West				6.9600	19.6403		0.6200		0.7000		0.7700		41.1130 (80)
West				5.8000	19.6403		0.6200		0.7000		0.7700		34.2609 (80)
Solar gains	203.1285	383.9571	609.4497	868.8090	1057.1342	1081.1604	1029.5629	887.7120	700.8913	448.6449	250.6180	168.8818	(83)
Total gains	898.6341	1074.3485	1272.8450	1490.0222	1634.6049	1619.7569	1545.6289	1413.2000	1250.8198	1040.9904	890.1845	844.7020	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	30.7848	30.8577	30.9295	31.2712	31.3360	31.6411	31.6411	Aug	Sep	Oct	Nov	Dec
alpha	3.0523	3.0572	3.0620	3.0847	3.0891	3.1094	3.1094	3.1132	3.1015	3.0891	3.0803	3.0713
util living area	0.9771	0.9604	0.9240	0.8450	0.7199	0.5633	0.4304	0.4821	0.7058	0.8975	0.9640	0.9808 (86)
MIT	19.0033	19.2805	19.7231	20.2552	20.6576	20.8862	20.9632	20.9474	20.7632	20.2025	19.5017	18.9529 (87)
Th 2	19.8274	19.8298	19.8322	19.8434	19.8455	19.8553	19.8553	19.8571	19.8515	19.8455	19.8412	19.8368 (88)
util rest of house	0.9724	0.9523	0.9086	0.8139	0.6655	0.4814	0.3271	0.3752	0.6295	0.8694	0.9553	0.9768 (89)
MIT 2	17.1991	17.5994	18.2314	18.9744	19.4972	19.7672	19.8368	19.8284	19.6445	18.9256	17.9311	17.1318 (90)
Living area fraction	17.4526	17.8356	18.4410	19.1544	19.6602	19.9245	19.9951	19.9856	fLA = Living area / (4) =	19.8017	19.1050	18.1518 (91)
MIT	17.4526	17.8356	18.4410	19.1544	19.6602	19.9245	19.9951	19.9856	19.8017	19.1050	18.1518	17.3877 (92)
Temperature adjustment	17.3026	17.6856	18.2910	19.0044	19.5102	19.7745	19.8451	19.8356	19.6517	18.9550	18.0018	-0.1500
adjusted MIT	17.3026	17.6856	18.2910	19.0044	19.5102	19.7745	19.8451	19.8356	19.6517	18.9550	18.0018	17.2377 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	859.8809	1000.5894	1122.1525	1172.2602	1058.8430	769.7301	504.1371	527.2874	768.4420	875.6882	832.4480	813.4866	(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	2123.2780	2082.9085	1916.4268	1624.3372	1252.9502	822.1044	515.5717	544.8608	885.3424	1340.3384	1756.2355	2109.4846	(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	939.9674	727.3184	590.9401	325.4955	144.4158	0.0000	0.0000	0.0000	0.0000	345.6997	665.1270	964.2225	(98)
Space heating												4703.1865	(98)
Space heating per m2												37.9381	(99)
												(98) / (4) =	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5225.7627 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	939.9674	727.3184	590.9401	325.4955	144.4158	0.0000	0.0000	0.0000	0.0000	345.6997	665.1270	964.2225	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	1044.4082	808.1316	656.6001	361.6617	160.4620	0.0000	0.0000	0.0000	0.0000	384.1108	739.0300	1071.3584	(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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater (217)m	89.4318	89.3700	89.2344	88.9231	88.3036	86.7000	86.7000	86.7000	86.7000	88.9399	89.3096	89.4567	(216)
Fuel for water heating, kWh/month	210.6092	184.9796	192.7232	170.8054	166.6667	148.9205	140.4217	157.6948	158.5610	177.2074	189.8115	204.6252	(219)
Water heating fuel used												2103.0261	(219)
Annual totals kWh/year													
Space heating fuel - main system												5225.7627	(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)												457.0496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												7272.5490	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5225.7627	3.4800	181.8565 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2103.0261	3.4800	73.1853 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	457.0496	13.1900	60.2848 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-588.2895	13.1900	-77.5954 (252)
Total energy cost			367.6238 (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] = 0.9138 (257)
SAP value	87.2527
SAP rating (Section 12)	87 (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	5225.7627	0.2160	1128.7648 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2103.0261	0.2160	454.2536 (264)
Space and water heating			1583.0184 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1553.8299 (272)
CO2 emissions per m2			12.5300 (273)
EI value			87.6775
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8831 = 3.940$, stars = 4
Water heating environmental impact	$0.216 / 0.8831 = 0.2446$, 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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3533 (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) =	0.3533 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3709	0.3444	0.3533	0.3356	0.3356	0.3268	0.3179	0.3091	0.3003	0.3268	0.3091	0.3268 (22b)
Effective ac	0.5688	0.5593	0.5624	0.5563	0.5563	0.5534	0.5505	0.5478	0.5451	0.5534	0.5478	0.5534 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.3514 (36)
Total fabric heat loss (33) + (36) = 104.3852 (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	55.7140	54.7857	55.0875	54.4916	54.4916	54.2051	53.9263	53.6550	53.3915	54.2051	53.6550	54.2051 (38)
Heat transfer coeff	160.0992	159.1710	159.4727	158.8768	158.8768	158.5903	158.3115	158.0403	157.7767	158.5903	158.0403	158.5903 (39)
Average = Sum(39)m / 12 =												158.7030 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2914	1.2839	1.2864	1.2816	1.2816	1.2793	1.2770	1.2748	1.2727	1.2793	1.2748	1.2793 (40)
HLP (average)												1.2802 (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 2.8774 (42)
Average daily hot water use (litres/day) 102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)												Total = Sum(45)m =	1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986	(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)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602	(61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270	(65)
Total per year (kWh/year) = Sum(64)m =												1859.9338	(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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(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					4.7600	13.4839	0.6200	0.7000			0.7700			19.3039 (74)
East					12.2900	25.1925	0.6200	0.7000			0.7700			93.1208 (76)
South					2.8400	56.7559	0.6200	0.7000			0.7700			48.4788 (78)
West					6.9600	25.1925	0.6200	0.7000			0.7700			52.7356 (80)
West					5.8000	25.1925	0.6200	0.7000			0.7700			43.9464 (80)
Solar gains	257.5855	414.9309	664.3011	952.0883	1099.9166	1221.3753	1154.2038	1020.6348	806.7417	523.2924	316.9152	210.4169 (83)		
Total gains	953.0912	1105.3222	1327.6964	1573.3015	1677.3872	1759.9718	1670.2698	1546.1228	1356.6702	1115.6379	956.4817	886.2370 (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	31.3995	31.5827	31.5229	31.6411	31.6411	31.6983	31.7541	31.8086	31.8617	31.6983	31.8086	31.6983	
alpha	3.0933	3.1055	3.1015	3.1094	3.1094	3.1132	3.1169	3.1206	3.1241	3.1132	3.1206	3.1132	
util living area	0.9705	0.9541	0.9083	0.8100	0.6695	0.4801	0.3590	0.3847	0.6301	0.8593	0.9496	0.9751	(86)
MIT	19.2033	19.4267	19.8823	20.3975	20.7521	20.9356	20.9806	20.9765	20.8480	20.3852	19.7311	19.1750	(87)
Th 2	19.8475	19.8534	19.8515	19.8553	19.8553	19.8571	19.8589	19.8606	19.8623	19.8571	19.8606	19.8571	(88)
util rest of house	0.9643	0.9448	0.8898	0.7733	0.6079	0.3951	0.2585	0.2783	0.5449	0.8215	0.9373	0.9697	(89)
MIT 2	17.5005	17.8238	18.4675	19.1711	19.6175	19.8134	19.8510	19.8509	19.7418	19.1787	18.2713	17.4662	(90)
Living area fraction	17.7397	18.0490	18.6663	19.3434	19.7770	19.9711	20.0097	20.0091	fLA = Living area / (4) =	19.8972	19.3482	18.4764	(91)
MIT	17.7397	18.0490	18.6663	19.3434	19.7770	19.9711	20.0097	20.0091	19.8972	19.3482	18.4764	17.7063	(92)
Temperature adjustment	17.5897	17.8990	18.5163	19.1934	19.6270	19.8211	19.8597	19.8591	19.7472	19.1982	18.3264	-0.1500	(93)
adjusted MIT	17.5897	17.8990	18.5163	19.1934	19.6270	19.8211	19.8597	19.8591	19.7472	19.1982	18.3264	17.5563	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	902.1124	1019.9130	1144.8980	1177.6427	996.9678	690.3855	431.9371	429.9815	726.2928	886.2181	874.2380	845.2111	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	2031.6164	2005.4016	1836.5320	1540.0590	1132.3094	716.9998	436.8925	436.0429	796.3372	1236.7232	1647.7965	1991.3114	(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	840.3510	662.2484	514.5757	260.9397	100.6941	0.0000	0.0000	0.0000	0.0000	260.7758	556.9621	852.6986	(98)
Space heating												4049.2455	(98)
Space heating per m2												(98) / (4) =	32.6631 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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 %)												90.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4499.1617	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	840.3510	662.2484	514.5757	260.9397	100.6941	0.0000	0.0000	0.0000	0.0000	260.7758	556.9621	852.6986	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	933.7233	735.8315	571.7508	289.9330	111.8824	0.0000	0.0000	0.0000	0.0000	289.7509	618.8468	947.4429	(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	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater	89.3771	89.3209	89.1500	88.7571	88.0110	86.7000	86.7000	86.7000	86.7000	88.7278	89.2077	86.7000	(216)
(217)m												89.3986	(217)
Fuel for water heating, kWh/month	210.7380	185.0814	192.9056	171.1250	167.2208	148.9205	140.4217	157.6948	158.5610	177.6311	190.0283	204.7582	(219)
Water heating fuel used												2105.0863	(219)
Annual totals kWh/year													
Space heating fuel - main system												4499.1617	(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)												457.0496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												6468.1983	(238)

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4499.1617	3.9200	176.3671 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2105.0863	3.9200	82.5194 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	457.0496	16.9600	77.5156 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-668.0993	16.9600	-113.3096 (252)
Total energy cost			323.8125 (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	4499.1617	0.2160	971.8189 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2105.0863	0.2160	454.6986 (264)
Space and water heating			1426.5176 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			1355.9078 (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	4499.1617	1.2200	5488.9773 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2105.0863	1.2200	2568.2052 (264)
Space and water heating			8057.1825 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	457.0496	3.0700	1403.1424 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			7639.5101 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

61.6239 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 33	-200 kg (14.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£33	1.62 kg/m ²	B 88 B 89
Total Savings	£33	1.62 kg/m ²	

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

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 2019)
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	£90	£99	-£8
Mains gas	£347	£306	£41
Space heating	£277	£277	£0
Water heating	£83	£50	£33
Lighting	£78	£78	£0
Generated (PV)	-£113	-£113	£0
Total cost of fuels	£324	£292	£33
Total cost of uses	£325	£292	£33
Delivered energy	52 kWh/m ²	44 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	1.4 tonnes	1.2 tonnes	0.2 tonnes
CO2 emissions per m ²	11 kg/m ²	9 kg/m ²	2 kg/m ²
Primary energy	62 kWh/m ²	53 kWh/m ²	9 kWh/m ²

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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3533 (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) =	0.3533 (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	0.4504	0.4416	0.4327	0.3886	0.3798	0.3356	0.3356	0.3268	0.3533	0.3798	0.3974	0.4151 (22b)
	0.6014	0.5975	0.5936	0.5755	0.5721	0.5563	0.5563	0.5534	0.5624	0.5721	0.5790	0.5861 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (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	58.9112	58.5254	58.1472	56.3710	56.0387	54.4916	54.4916	54.2051	55.0875	56.0387	56.7110	57.4138 (38)
Heat transfer coeff	163.2964	162.9106	162.5325	160.7562	160.4239	158.8768	158.8768	158.5903	159.4727	160.4239	161.0962	161.7990 (39)
Average = Sum(39)m / 12 =												160.7546 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3172	1.3141	1.3111	1.2967	1.2941	1.2816	1.2816	1.2793	1.2864	1.2941	1.2995	1.3051 (40)
HLP (average)												1.2967 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8774 (42)
102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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)	
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602 (61)	
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (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												1.1241 (H8)	
Utilisation factor												0.5892 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												102.5391 (H14)	
Volume ratio Veff/V												0.7314 (H15)	
Solar storage volume factor												0.9374 (H16)	
Solar input												-880.7738 (H17)	
Solar input	-25.5407	-42.6201	-72.5868	-97.2807	-120.1821	-118.1581	-116.5966	-101.8710	-79.7855	-54.4841	-30.2949	-21.3732 (63)	
	Solar input (sum of months) = Sum(63)m =											-880.7738 (63)	
Output from w/h	162.8109	122.6962	99.3885	54.6048	26.9906	10.9560	5.1490	34.8503	57.6869	103.1241	139.2249	161.6778 (64)	
	Total per year (kWh/year) = Sum(64)m =											979.1600 (64)	
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270 (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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(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					4.7600	10.6334		0.6200	0.7000	0.7700		15.2231 (74)	
East					12.2900	19.6403		0.6200	0.7000	0.7700		72.5976 (76)	
South					2.8400	46.7521		0.6200	0.7000	0.7700		39.9339 (78)	
West					6.9600	19.6403		0.6200	0.7000	0.7700		41.1130 (80)	
West					5.8000	19.6403		0.6200	0.7000	0.7700		34.2609 (80)	
Solar gains	203.1285	383.9571	609.4497	868.8090	1057.1342	1081.1604	1029.5629	887.7120	700.8913	448.6449	250.6180	168.8818	(83)
Total gains	898.6341	1074.3485	1272.8450	1490.0222	1634.6049	1619.7569	1545.6289	1413.2000	1250.8198	1040.9904	890.1845	844.7020	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	30.7848	30.8577	30.9295	31.2712	31.3360	31.6411	31.6411	31.6983	31.5229	31.3360	31.2052	31.0697
util living area	3.0523	3.0572	3.0620	3.0847	3.0891	3.1094	3.1094	3.1132	3.1015	3.0891	3.0803	3.0713
	0.9771	0.9604	0.9240	0.8450	0.7199	0.5633	0.4304	0.4821	0.7058	0.8975	0.9640	0.9808 (86)
MIT	19.0033	19.2805	19.7231	20.2552	20.6576	20.8862	20.9632	20.9474	20.7632	20.2025	19.5017	18.9529 (87)
Th 2	19.8274	19.8298	19.8322	19.8434	19.8455	19.8553	19.8553	19.8571	19.8515	19.8455	19.8412	19.8368 (88)
util rest of house	0.9724	0.9523	0.9086	0.8139	0.6655	0.4814	0.3271	0.3752	0.6295	0.8694	0.9553	0.9768 (89)
MIT 2	17.1991	17.5994	18.2314	18.9744	19.4972	19.7672	19.8368	19.8284	19.6445	18.9256	17.9311	17.1318 (90)
Living area fraction	17.4526	17.8356	18.4410	19.1544	19.6602	19.9245	19.9951	19.9856	19.8017	19.1050	18.1518	17.3877 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3026	17.6856	18.2910	19.0044	19.5102	19.7745	19.8451	19.8356	19.6517	18.9550	18.0018	17.2377 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9569	0.9313	0.8816	0.7867	0.6478	0.4752	0.3262	0.3731	0.6144	0.8412	0.9351	0.9630	(94)
Useful gains	859.8809	1000.5894	1122.1525	1172.2602	1058.8430	769.7301	504.1371	527.2874	768.4420	875.6882	832.4480	813.4866	(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	2123.2780	2082.9085	1916.4268	1624.3372	1252.9502	822.1044	515.5717	544.8608	885.3424	1340.3384	1756.2355	2109.4846	(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	939.9674	727.3184	590.9401	325.4955	144.4158	0.0000	0.0000	0.0000	0.0000	345.6997	665.1270	964.2225	(98)
Space heating												4703.1865	(98)
Space heating per m2												(98) / (4) =	37.9381 (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 %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5225.7627 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	939.9674	727.3184	590.9401	325.4955	144.4158	0.0000	0.0000	0.0000	0.0000	345.6997	665.1270	964.2225	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	1044.4082	808.1316	656.6001	361.6617	160.4620	0.0000	0.0000	0.0000	0.0000	384.1108	739.0300	1071.3584	(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	162.8109	122.6962	99.3885	54.6048	26.9906	10.9560	5.1490	34.8503	57.6869	103.1241	139.2249	161.6778	(64)
Efficiency of water heater	89.4971	89.5082	89.5095	89.5106	89.4638	86.7000	86.7000	86.7000	86.7000	89.2197	89.4109	89.5108	(216)
(217)m	89.4971	89.5082	89.5095	89.5106	89.4638	86.7000	86.7000	86.7000	86.7000	89.2197	89.4109	89.5108	(217)
Fuel for water heating, kWh/month	181.9175	137.0782	111.0368	61.0038	30.1693	12.6366	5.9389	40.1965	66.5362	115.5844	155.7135	180.6239	(219)
Water heating fuel used												1098.4355	(219)
Annual totals kWh/year													
Space heating fuel - main system												5225.7627	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													457.0496 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6317.9584	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5225.7627	3.4800	181.8565	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1098.4355	3.4800	38.2256	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	457.0496	13.1900	60.2848	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			339.2591	(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] =	0.8433 (257)
SAP value		88.2363
SAP rating (Section 12)		88 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5225.7627	0.2160	1128.7648 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1098.4355	0.2160	237.2621 (264)
Space and water heating			1366.0268 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1362.7883 (272)
CO2 emissions per m2			10.9900 (273)
EI value			89.1925
EI rating			89 (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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 296.8223 (5)
Dwelling volume			

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.3700
Infiltration rate					0.3533 (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) =	0.3533 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3709	0.3444	0.3533	0.3356	0.3356	0.3268	0.3179	0.3091	0.3003	0.3268	0.3091	0.3268 (22b)
Effective ac	0.5688	0.5593	0.5624	0.5563	0.5563	0.5534	0.5505	0.5478	0.5451	0.5534	0.5478	0.5534 (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
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Total fabric heat loss
 (28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
 145.9817 (35)
 11.3514 (36)
 (33) + (36) = 104.3852 (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	55.7140	54.7857	55.0875	54.4916	54.4916	54.2051	53.9263	53.6550	53.3915	54.2051	53.6550	54.2051 (38)
Heat transfer coeff	160.0992	159.1710	159.4727	158.8768	158.8768	158.5903	158.3115	158.0403	157.7767	158.5903	158.0403	158.5903 (39)
Average = Sum(39)m / 12 =												158.7030 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2914	1.2839	1.2864	1.2816	1.2816	1.2793	1.2770	1.2748	1.2727	1.2793	1.2748	1.2793 (40)
HLP (average)												1.2802 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
 Average daily hot water use (litres/day)
 2.8774 (42)
 102.5391 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

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 content (annual)	Total = Sum (45)m = 1613.3389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (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)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	21.0602 (61)
Total heat required for water heating calculated for each month											
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1208.1510 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											2029.6937 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.2581 (H8)
Collector performance factor											0.5484 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											102.5391 (H14)
Solar storage volume factor											0.7314 (H15)
Solar input											0.9374 (H16)
Solar input	-29.9291	-42.5572	-73.1457	-98.6904	-115.9178	-123.8186	-121.2146	-108.4908	-84.9408	-58.7251	-35.3982
Solar input (sum of months) = Sum (63)m =											-917.4387 (H17)
Output from w/h	158.4225	122.7591	98.8297	53.1951	31.2548	5.2955	0.5310	28.2306	52.5316	98.8830	134.1217
Total per year (kWh/year) = Sum (64)m =											942.4951 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866
											59.1270 (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	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(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)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(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					4.7600	13.4839	0.6200		0.7000	0.7700		19.3039 (74)	
East					12.2900	25.1925	0.6200		0.7000	0.7700		93.1208 (76)	
South					2.8400	56.7559	0.6200		0.7000	0.7700		48.4788 (78)	
West					6.9600	25.1925	0.6200		0.7000	0.7700		52.7356 (80)	
West					5.8000	25.1925	0.6200		0.7000	0.7700		43.9464 (80)	
Solar gains	257.5855	414.9309	664.3011	952.0883	1099.9166	1221.3753	1154.2038	1020.6348	806.7417	523.2924	316.9152	210.4169 (83)	
Total gains	953.0912	1105.3222	1327.6964	1573.3015	1677.3872	1759.9718	1670.2698	1546.1228	1356.6702	1115.6379	956.4817	886.2370 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	31.3995	31.5827	31.5229	31.6411	31.6411	31.6983	31.7541	31.8086	31.8617	31.6983	31.8086	31.6983	
alpha	3.0933	3.1055	3.1015	3.1094	3.1094	3.1132	3.1169	3.1206	3.1241	3.1132	3.1206	3.1132	
util living area	0.9705	0.9541	0.9083	0.8100	0.6695	0.4801	0.3590	0.3847	0.6301	0.8593	0.9496	0.9751	(86)
MIT	19.2033	19.4267	19.8823	20.3975	20.7521	20.9356	20.9806	20.9765	20.8480	20.3852	19.7311	19.1750	(87)
Th 2	19.8475	19.8534	19.8515	19.8553	19.8553	19.8571	19.8589	19.8606	19.8623	19.8571	19.8606	19.8571	(88)
util rest of house	0.9643	0.9448	0.8898	0.7733	0.6079	0.3951	0.2585	0.2783	0.5449	0.8215	0.9373	0.9697	(89)
MIT 2	17.5005	17.8238	18.4675	19.1711	19.6175	19.8134	19.8510	19.8509	19.7418	19.1787	18.2713	17.4662	(90)
Living area fraction	17.7397	18.0490	18.6663	19.3434	19.7770	19.9711	20.0097	20.0091	19.8972	19.3482	18.4764	17.7063	(92)
Temperature adjustment	17.5897	17.8990	18.5163	19.1934	19.6270	19.8211	19.8597	19.8591	19.7472	19.1982	18.3264	17.5563	(93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9465	0.9227	0.8623	0.7485	0.5944	0.3923	0.2586	0.2781	0.5353	0.7944	0.9140	0.9537	(94)
Useful gains	902.1124	1019.9130	1144.8980	1177.6427	996.9678	690.3855	431.9371	429.9815	726.2928	886.2181	874.2380	845.2111	(95)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	2031.6164	2005.4016	1836.5320	1540.0590	1132.3094	716.9998	436.8925	436.0429	796.3372	1236.7232	1647.7965	1991.3114	(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	840.3510	662.2484	514.5757	260.9397	100.6941	0.0000	0.0000	0.0000	0.0000	260.7758	556.9621	852.6986	(98)
Space heating												4049.2455	(98)
Space heating per m2											(98) / (4) =	32.6631	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4499.1617	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	840.3510	662.2484	514.5757	260.9397	100.6941	0.0000	0.0000	0.0000	0.0000	260.7758	556.9621	852.6986	(98)	
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)	
Space heating fuel (main heating system)	933.7233	735.8315	571.7508	289.9330	111.8824	0.0000	0.0000	0.0000	0.0000	289.7509	618.8468	947.4429	(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	158.4225	122.7591	98.8297	53.1951	31.2548	5.2955	0.5310	28.2306	52.5316	98.8830	134.1217	158.4406	(64)	
Efficiency of water heater	89.4599	89.4675	89.4514	89.4236	89.1958	86.7000	86.7000	86.7000	86.7000	89.0679	89.3401	89.4664	(216)	
Fuel for water heating, kWh/month	177.0877	137.2108	110.4842	59.4866	35.0407	6.1079	0.6124	32.5613	60.5901	111.0197	150.1249	177.0951	(219)	
Water heating fuel used												1057.4213	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4499.1617	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													457.0496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)	
Total delivered energy for all uses												5470.5334	(238)	

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4499.1617	3.9200	176.3671	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1057.4213	3.9200	41.4509	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	457.0496	16.9600	77.5156	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	16.9600	-113.3096	(252)
Total energy cost			291.2240	(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	4499.1617	0.2160	971.8189	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1057.4213	0.2160	228.4030	(264)
Space and water heating			1200.2219	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	457.0496	0.5190	237.2088	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			1155.5622 (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	4499.1617	1.2200	5488.9773 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1057.4213	1.2200	1290.0540 (264)
Space and water heating			6779.0313 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	457.0496	3.0700	1403.1424 (268)

Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			6514.8588 (272)
Primary energy kWh/m2/year			52.5519 (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	East
Overshading	Average or unknown
Thermal mass parameter	146.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	391.81 (P1)
Transmission heat loss coefficient	104.39 (37)
Summer heat loss coefficient	496.19 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	4.7600	87.1704	0.6200	0.7000	0.9000	145.8650
East	12.2900	125.2818	0.6200	0.7000	0.9000	541.2708
South	2.8400	118.5567	0.6200	0.7000	0.9000	118.3639
West	6.9600	125.2818	0.6200	0.7000	0.9000	306.5292
West	5.8000	125.2818	0.6200	0.7000	0.9000	255.4410

total: 1367.4698

Solar gains	Jun 1471	Jul 1367	Aug 1205	(P3)
Internal gains	536	513	522	
Total summer gains	2007	1881	1728	(P5)
Summer gain/loss ratio	4.04	3.79	3.48	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 146.0)	0.98	0.98	0.98	
Threshold temperature	20.42	22.07	21.76	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			