

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-141				Issued on Date	27/06/2019
Assessment Reference	As Built	Prop Type Ref	P506 - Det (As)			
Property	31, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	89 B	DER	11.58	TER	13.88	
Environmental	89 B	% DER<TER	16.56			
CO ₂ Emissions (t/year)	1.68	DFEE	45.13	TFEE	50.19	
General Requirements Compliance	Pass	% DFEE<TFEE	10.09			
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 183 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) 13.88 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 11.58 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.2 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)45.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.37 (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:	4.89 (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 Ultra 18 Heat 18

Efficiency: 89.2% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.61 kWh/day

Permitted by DBSCG 2.56 OK

Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK

Independent timer for DHW OK

Boiler interlock Yes OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading:	Average
Windows facing North:	1.70 m ² , No overhang
Windows facing North East:	8.45 m ² , No overhang
Windows facing East:	1.70 m ² , No overhang
Windows facing South East:	1.83 m ² , No overhang
Windows facing South West:	19.15 m ² , No overhang
Windows facing North West:	1.13 m ² , No overhang
Air change rate:	4.00 ach
Blinds/curtains:	None

10 Key features

Door U-value 0.90 W/m²K

Thermal bridging y-value 0.035 W/m²K

Photovoltaic array 1.08 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	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1139 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.3584 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3047 (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	0.3884	0.3808	0.3732	0.3351	0.3275	0.2894	0.2894	0.2818	0.3047	0.3275	0.3427	0.3580 (22b)
Effective ac	0.5754	0.5725	0.5696	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5587	0.5641 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			19.8100	1.3258	26.2633		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			92.4600	0.1500	13.8690	75.0000	6934.5000 (28a)
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.2500	37.1175	60.0000	8908.2000 (29a)
External Roof 1	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	1.6000		1.6000	0.1300	0.2080	9.0000	14.4000 (30)
Total net area of external elements Aum(A, m ²)			369.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.9460		(33)
GF			62.5600			39.0000	2439.8400 (32c)
GF			72.5200			9.0000	652.6800 (32c)
FF			188.3400			9.0000	1695.0600 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24733.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.9192 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0533 (36)
Total fabric heat loss						(33) + (36) =	122.9993 (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	83.3480	82.9237	82.5078	80.5543	80.1888	78.4874	78.4874	78.1723	79.1428	80.1888	80.9282	81.7012 (38)
Heat transfer coeff	206.3473	205.9230	205.5071	203.5536	203.1881	201.4867	201.4867	201.1716	202.1421	203.1881	203.9275	204.7005 (39)
Average = Sum(39)m / 12 =												203.5519 (39)
HLP	1.1256	1.1233	1.1210	1.1104	1.1084	1.0991	1.0991	1.0974	1.1027	1.1084	1.1124	1.1166 (40)
HLP (average)												1.1104 (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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4769	111.2777	107.0786	102.8794	98.6802	94.4811	94.4811	98.6802	102.8794	107.0786	111.2777	115.4769 (44)

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Energy content (annual)	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6873	22.4663	23.1832	20.2117	19.3936	16.7352	15.5076	17.7952	18.0078	20.9863	22.9082	24.8768 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (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	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (64)
Heat gains from water heating, kWh/month	97.1113	86.0838	91.5605	83.6778	83.1602	75.9716	74.5463	79.6171	78.7924	86.6907	89.6550	95.3146 (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	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1734	28.5761	23.2397	17.5939	13.1517	11.1032	11.9974	15.5947	20.9311	26.5768	31.0191	33.0676 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.9030	358.5858	349.3053	329.5482	304.6084	281.1686	265.5093	261.8266	271.1070	290.8641	315.8039	339.2437 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008 (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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067 (71)
Water heating gains (Table 5)	130.5259	128.1009	123.0652	116.2191	111.7744	105.5160	100.1966	107.0122	109.4339	116.5197	124.5209	128.1111 (72)
Total internal gains	588.3048	585.9653	566.3126	534.0638	500.2370	468.4903	448.4058	455.1360	472.1745	504.6632	542.0463	571.1249 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.7000	10.6334	0.6200	0.7000	0.7700	5.4368 (74)			
Northeast				8.4500	11.2829	0.6200	0.7000	0.7700	28.6749 (75)			
East				1.7000	19.6403	0.6200	0.7000	0.7700	10.0420 (76)			
Southeast				1.8300	36.7938	0.6200	0.7000	0.7700	20.2511 (77)			
Southwest				5.0000	36.7938	0.6200	0.7000	0.7700	55.3309 (79)			
Northwest				1.1300	11.2829	0.6200	0.7000	0.7700	3.8346 (81)			
Southwest				14.1500	36.7938	0.6200	0.7000	0.7700	156.5865 (79)			
Solar gains	280.1569	491.6774	710.3291	941.7889	1110.1769	1126.2086	1075.7920	946.6622	790.0249	553.6250	338.2180	238.0273 (83)
Total gains	868.4617	1077.6427	1276.6417	1475.8527	1610.4139	1594.6989	1524.1978	1401.7982	1262.1994	1058.2882	880.2644	809.1522 (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	33.2952	33.3638	33.4314	33.7522	33.8129	34.0984	34.0984	34.1519	33.9879	33.8129	33.6903	33.5631
alpha	3.2197	3.2243	3.2288	3.2501	3.2542	3.2732	3.2732	3.2768	3.2659	3.2542	3.2460	3.2375
util living area	0.9911	0.9818	0.9619	0.9144	0.8220	0.6792	0.5358	0.5909	0.8023	0.9445	0.9844	0.9929 (86)
MIT	18.9032	19.1680	19.5773	20.0930	20.5388	20.8313	20.9429	20.9206	20.6880	20.0923	19.3977	18.8569 (87)
Th 2	19.9800	19.9819	19.9837	19.9924	19.9940	20.0016	20.0016	20.0030	19.9987	19.9940	19.9907	19.9873 (88)
util rest of house	0.9894	0.9782	0.9541	0.8960	0.7820	0.6053	0.4310	0.4865	0.7433	0.9288	0.9807	0.9915 (89)
MIT 2	17.1571	17.5432	18.1365	18.8761	19.4855	19.8543	19.9675	19.9516	19.6948	18.8888	17.8855	17.0939 (90)
Living area fraction									fLA = Living area / (4) =			0.1372 (91)
MIT	17.3967	17.7661	18.3342	19.0430	19.6300	19.9884	20.1013	20.0846	19.8310	19.0539	18.0929	17.3358 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2467	17.6161	18.1842	18.8930	19.4800	19.8384	19.9513	19.9346	19.6810	18.9039	17.9429	17.1858 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	852.5916	1040.5493	1193.0979	1284.0140	1220.3612	943.8947	648.2269	670.9592	909.9722	958.0455	853.0698	797.1063 (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	2671.5160	2618.5417	2401.1769	2034.1149	1580.8127	1055.4603	675.2380	711.0551	1128.1621	1687.2522	2211.1757	2658.1924 (97)

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Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1353.2797	1060.4109	898.8108	540.0727	268.1760	0.0000	0.0000	0.0000	0.0000	542.5298	977.8362	1384.6481 (98)
Space heating												7025.7641 (98)
Space heating per m2										(98) / (4) =		38.3251 (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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												7789.0955 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1353.2797	1060.4109	898.8108	540.0727	268.1760	0.0000	0.0000	0.0000	0.0000	542.5298	977.8362	1384.6481 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	1500.3101	1175.6218	996.4643	598.7502	297.3126	0.0000	0.0000	0.0000	0.0000	601.4743	1084.0756	1535.0866 (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	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (64)
Efficiency of water heater	88.5244	88.3519	88.0023	87.2247	85.5815	79.5000	79.5000	79.5000	79.5000	87.1560	88.1739	79.5000 (216)
Fuel for water heating, kWh/month	250.1713	220.8552	232.6855	210.1910	209.7468	201.4616	193.2050	212.3882	212.1329	218.1405	228.3162	243.8850 (219)
Water heating fuel used												2633.1792 (219)
Annual totals kWh/year												
Space heating fuel - main system												7789.0955 (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)												568.1920 (232)
Energy saving/generation technologies (Appendices M, N and Q)												
PV Unit 0 (0.80 * 1.08 * 1029 * 1.00) =										-889.2173		-889.2173 (233)
Total delivered energy for all uses												10176.2494 (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	7789.0955	0.2160	1682.4446 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2633.1792	0.2160	568.7667 (264)
Space and water heating			2251.2113 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	568.1920	0.5190	294.8916 (268)
Energy saving/generation technologies			
PV Unit	-889.2173	0.5190	-461.5038 (269)
Total CO2, kg/year			2123.5242 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			11.5800 (273)

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

DER			11.5800 ZC1
Total Floor Area		TFA	183.3200
Assumed number of occupants		N	2.9802
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			11.4722 ZC2
CO2 emissions from cooking, equation (L16)			1.0393 ZC3
Total CO2 emissions			24.0915 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			24.0915 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (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) = 0.0911 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3411 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2900 (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	0.3697	0.3625	0.3552	0.3190	0.3117	0.2755	0.2755	0.2682	0.2900	0.3117	0.3262	0.3407 (22b)
Effective ac	0.5683	0.5657	0.5631	0.5509	0.5486	0.5379	0.5379	0.5360	0.5420	0.5486	0.5532	0.5580 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			33.9600	1.3258	45.0227		(27)
Heat Loss Floor 1			92.4600	0.1300	12.0198		(28a)
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.1800	26.7246		(29a)
External Roof 1	90.8600		90.8600	0.1300	11.8118		(30)
Bay	1.6000		1.6000	0.1300	0.2080		(30)
Total net area of external elements Aum(A, m ²)			369.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	97.9169		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5773 (36)
Total fabric heat loss						(33) + (36) =	113.4942 (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	82.3196	81.9352	81.5585	79.7888	79.4577	77.9164	77.9164	77.6310	78.5101	79.4577	80.1275	80.8278 (38)
Heat transfer coeff	195.8138	195.4295	195.0527	193.2831	192.9520	191.4107	191.4107	191.1252	192.0044	192.9520	193.6218	194.3220 (39)
Average = Sum(39)m / 12 =												193.2815 (39)
HLP	1.0682	1.0661	1.0640	1.0543	1.0525	1.0441	1.0441	1.0426	1.0474	1.0525	1.0562	1.0600 (40)
HLP (average)												1.0543 (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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.4769	111.2777	107.0786	102.8794	98.6802	94.4811	94.4811	98.6802	102.8794	107.0786	111.2777	115.4769 (44)
Energy content (annual)	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6873	22.4663	23.1832	20.2117	19.3936	16.7352	15.5076	17.7952	18.0078	20.9863	22.9082	24.8768 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

AES
Sustainability
Consultants

Temperature factor from Table 2b											0.5400	(49)	
Enter (49) or (54) in (55)											1.0208	(55)	
Total storage loss													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	30.6236	31.6444	(56)	
If cylinder contains dedicated solar storage													
	31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	30.6236	31.6444	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	226.1557	199.3686	209.4615	187.8802	184.1974	164.7036	158.2909	173.5416	173.1873	194.8155	205.8569	220.7522	(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	(64)
Output from w/h													
	226.1557	199.3686	209.4615	187.8802	184.1974	164.7036	158.2909	173.5416	173.1873	194.8155	205.8569	220.7522	(63)
								Total per year (kWh/year) = Sum(64)m =				2298.2113	(64)
Heat gains from water heating, kWh/month													
	100.8657	89.4749	95.3149	87.3111	86.9146	79.6048	78.3007	83.3715	82.4257	90.4451	93.2883	99.0690	(65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1734	28.5761	23.2397	17.5939	13.1517	11.1032	11.9974	15.5947	20.9311	26.5768	31.0191	33.0676 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.9030	358.5858	349.3053	329.5482	304.6084	281.1686	265.5093	261.8266	271.1070	290.8641	315.8039	339.2437 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008 (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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067 (71)
Water heating gains (Table 5)	135.5722	133.1472	128.1114	121.2654	116.8207	110.5623	105.2428	112.0585	114.4801	121.5659	129.5671	133.1573 (72)
Total internal gains	593.3510	591.0115	571.3588	539.1100	505.2833	473.5366	453.4520	460.1822	477.2208	509.7094	547.0926	576.1711 (73)

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.7000	10.6334	0.6300	0.7000	0.7700		5.5245 (74)	
Northeast					8.4500	11.2829	0.6300	0.7000	0.7700		29.1374 (75)	
East					1.7000	19.6403	0.6300	0.7000	0.7700		10.2039 (76)	
Southeast					1.8300	36.7938	0.6300	0.7000	0.7700		20.5778 (77)	
Southwest					19.1500	36.7938	0.6300	0.7000	0.7700		215.3355 (79)	
Northwest					1.1300	11.2829	0.6300	0.7000	0.7700		3.8965 (81)	
Solar gains	284.6756	499.6077	721.7860	956.9790	1128.0829	1144.3733	1093.1434	961.9310	802.7672	562.5544	343.6732	241.8664 (83)
Total gains	878.0266	1090.6192	1293.1448	1496.0890	1633.3662	1617.9098	1546.5955	1422.1131	1279.9880	1072.2639	890.7657	818.0375 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil/m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	65.0136	65.1414	65.2673	65.8648	65.9778	66.5091	66.5091	66.6084	66.3035	65.9778	65.7496	65.5127
alpha	5.3342	5.3428	5.3512	5.3910	5.3985	5.4339	5.4339	5.4406	5.4202	5.3985	5.3833	5.3675
util living area	0.9993	0.9977	0.9917	0.9656	0.8805	0.7085	0.5352	0.6002	0.8584	0.9839	0.9983	0.9996 (86)
MIT	19.7557	19.9292	20.1954	20.5338	20.8142	20.9589	20.9925	20.9866	20.8820	20.5036	20.0607	19.7255 (87)
Th 2	20.0269	20.0286	20.0303	20.0383	20.0398	20.0467	20.0467	20.0480	20.0440	20.0398	20.0368	20.0336 (88)
util rest of house	0.9991	0.9969	0.9887	0.9525	0.8374	0.6220	0.4242	0.4851	0.7921	0.9756	0.9975	0.9994 (89)
MIT 2	18.3494	18.6042	18.9931	19.4825	19.8553	20.0190	20.0439	20.0423	19.9466	19.4475	18.8029	18.3101 (90)
Living area fraction									fLA = Living area / (4) =			0.1372 (91)
MIT	18.5424	18.7860	19.1581	19.6267	19.9869	20.1480	20.1740	20.1719	20.0749	19.5924	18.9755	18.5043 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5424	18.7860	19.1581	19.6267	19.9869	20.1480	20.1740	20.1719	20.0749	19.5924	18.9755	18.5043 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9986	0.9954	0.9848	0.9453	0.8346	0.6318	0.4394	0.5006	0.7946	0.9702	0.9963	0.9990 (94)
Useful gains	876.7612	1085.6001	1273.4801	1414.1784	1363.2015	1022.2660	679.5474	711.9652	1017.0442	1040.3186	887.4476	817.2242 (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	2788.8500	2713.7348	2468.9938	2073.2886	1598.9669	1061.9407	684.1056	720.8981	1147.2109	1735.1048	2299.3509	2779.6428 (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	1422.5941	1094.1065	889.4622	474.5594	175.4095	0.0000	0.0000	0.0000	0.0000	516.9209	1016.5704	1460.0395 (98)
Space heating												7049.6624 (98)
Space heating per m2												38.4555 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7539.7459 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1422.5941	1094.1065	889.4622	474.5594	175.4095	0.0000	0.0000	0.0000	0.0000	516.9209	1016.5704	1460.0395	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1521.4910	1170.1674	951.2965	507.5501	187.6037	0.0000	0.0000	0.0000	0.0000	552.8566	1087.2410	1561.5395	(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	226.1557	199.3686	209.4615	187.8802	184.1974	164.7036	158.2909	173.5416	173.1873	194.8155	205.8569	220.7522	(64)
Efficiency of water heater (217)m	88.8656	88.6675	88.2447	87.1845	84.6838	79.8000	79.8000	79.8000	79.8000	87.2961	88.5016	79.8000	(216)
Fuel for water heating, kWh/month	254.4919	224.8497	237.3645	215.4973	217.5119	206.3955	198.3596	217.4707	217.0267	223.1663	232.6023	248.2207	(219)
Water heating fuel used												2692.9570	(219)
Annual totals kWh/year													
Space heating fuel - main system												7539.7459	(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)												568.1920	(232)
Total delivered energy for all uses												10875.8948	(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	7539.7459	0.2160	1628.5851 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2692.9570	0.2160	581.6787 (264)
Space and water heating			2210.2638 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	568.1920	0.5190	294.8916 (268)
Total CO2, kg/m2/year			2544.0804 (272)
Emissions per m2 for space and water heating			12.0569 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.6086 (272b)
Emissions per m2 for pumps and fans			0.2123 (272c)
Target Carbon Dioxide Emission Rate (TER) = (12.0569 * 1.00) + 1.6086 + 0.2123, rounded to 2 d.p.			13.8800 (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	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (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) = 0.0911 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.3356 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2853 (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	0.3637	0.3566	0.3495	0.3138	0.3067	0.2710	0.2710	0.2639	0.2853	0.3067	0.3209	0.3352 (22b)
Effective ac	0.5662	0.5636	0.5611	0.5492	0.5470	0.5367	0.5367	0.5348	0.5407	0.5470	0.5515	0.5562 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			19.8100	1.3258	26.2633		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			92.4600	0.1500	13.8690	75.0000	6934.5000 (28a)
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.2500	37.1175	60.0000	8908.2000 (29a)
External Roof 1	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	1.6000		1.6000	0.1300	0.2080	9.0000	14.4000 (30)
Total net area of external elements Aum(A, m ²)			369.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.9460		(33)
GF			62.5600			39.0000	2439.8400 (32c)
GF			72.5200			9.0000	652.6800 (32c)
FF			188.3400			9.0000	1695.0600 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			9.0000	817.7400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23915.6400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							130.4584 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0533 (36)
Total fabric heat loss						(33) + (36) =	122.9993 (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	82.0030	81.6309	81.2662	79.5532	79.2327	77.7407	77.7407	77.4644	78.3154	79.2327	79.8810	80.5589 (38)
Heat transfer coeff	205.0023	204.6302	204.2655	202.5525	202.2320	200.7400	200.7400	200.4637	201.3147	202.2320	202.8803	203.5582 (39)
Average = Sum(39)m / 12 =												202.5509 (39)
HLP	1.1183	1.1162	1.1143	1.1049	1.1032	1.0950	1.0950	1.0935	1.0982	1.1032	1.1067	1.1104 (40)
HLP (average)												1.1049 (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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4769	111.2777	107.0786	102.8794	98.6802	94.4811	94.4811	98.6802	102.8794	107.0786	111.2777	115.4769 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Energy content (annual)										Total =	Sum (45)m =	1651.7281 (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	36.3904	31.8273	32.8429	28.6332	27.4743	23.7082	21.9691	25.2099	25.5110	29.7306	32.4533	35.2421 (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	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1734	28.5761	23.2397	17.5939	13.1517	11.1032	11.9974	15.5947	20.9311	26.5768	31.0191	33.0676 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.9030	358.5858	349.3053	329.5482	304.6084	281.1686	265.5093	261.8266	271.1070	290.8641	315.8039	339.2437 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008 (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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067 (71)
Water heating gains (Table 5)	48.9118	47.3620	44.1437	39.7684	36.9278	32.9281	29.5284	33.8843	35.4319	39.9605	45.0740	47.3685 (72)
Total internal gains	503.6907	502.2264	484.3911	454.6130	422.3904	392.9023	374.7376	379.0080	395.1726	425.1039	459.5995	487.3823 (73)

6. Solar gains

[Jan]													
	Area				Solar flux		g		FF		Access		Gains
	m2				Table 6a		Specific data		Specific data		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
North	1.7000				10.6334		0.6200		0.7000		0.7700		5.4368 (74)
Northeast	8.4500				11.2829		0.6200		0.7000		0.7700		28.6749 (75)
East	1.7000				19.6403		0.6200		0.7000		0.7700		10.0420 (76)
Southeast	1.8300				36.7938		0.6200		0.7000		0.7700		20.2511 (77)
Southwest	5.0000				36.7938		0.6200		0.7000		0.7700		55.3309 (79)
Northwest	1.1300				11.2829		0.6200		0.7000		0.7700		3.8346 (81)
Southwest	14.1500				36.7938		0.6200		0.7000		0.7700		156.5865 (79)
Solar gains	280.1569	491.6774	710.3291	941.7889	1110.1769	1126.2086	1075.7920	946.6622	790.0249	553.6250	338.2180	238.0273 (83)	
Total gains	783.8476	993.9038	1194.7202	1396.4019	1532.5672	1519.1109	1450.5296	1325.6702	1185.1975	978.7290	797.8175	725.4096 (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	32.4057	32.4646	32.5225	32.7976	32.8496	33.0937	33.0937	33.1393	32.9993	32.8496	32.7446	32.6355
alpha	3.1604	3.1643	3.1682	3.1865	3.1900	3.2062	3.2062	3.2093	3.2000	3.1900	3.1830	3.1757
util living area	0.9927	0.9841	0.9656	0.9208	0.8327	0.6950	0.5535	0.6112	0.8185	0.9514	0.9870	0.9943 (86)
MIT	18.8006	19.0730	19.4949	20.0276	20.4951	20.8083	20.9327	20.9063	20.6496	20.0212	19.3044	18.7513 (87)
Th 2	19.9859	19.9876	19.9892	19.9968	19.9983	20.0049	20.0049	20.0061	20.0023	19.9983	19.9954	19.9924 (88)
util rest of house	0.9912	0.9811	0.9586	0.9038	0.7947	0.6226	0.4479	0.5069	0.7629	0.9378	0.9840	0.9931 (89)
MIT 2	17.9585	18.2304	18.6490	19.1741	19.6139	19.8884	19.9766	19.9635	19.7648	19.1775	18.4678	17.9139 (90)
Living area fraction									fLA =	Living area / (4) =		0.1372 (91)
MIT	18.0740	18.3460	18.7651	19.2912	19.7348	20.0146	20.1078	20.0928	19.8861	19.2932	18.5825	18.0287 (92)
Temperature adjustment												0.0000
adjusted MIT	18.0740	18.3460	18.7651	19.2912	19.7348	20.0146	20.1078	20.0928	19.8861	19.2932	18.5825	18.0287 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9874	0.9742	0.9475	0.8890	0.7831	0.6234	0.4596	0.5168	0.7553	0.9251	0.9780	0.9900 (94)
Ext temp.	773.9372	968.2190	1132.0165	1241.4652	1200.1631	946.9837	666.6461	685.1467	895.1308	905.4561	780.2996	718.1227 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	2823.7047	2751.4599	2505.3274	2104.7667	1624.8851	1086.9254	704.1495	740.2809	1164.8353	1758.0519	2329.5820	2814.9541 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	1525.0270	1198.3379	1021.7433	621.5770	315.9932	0.0000	0.0000	0.0000	0.0000	634.3313	1115.4833	1560.0426 (98)
												7992.5356 (98)
										(98) / (4) =		43.5988 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	1886.9558	1485.4758	1523.5239	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7673	0.8346	0.7994	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1447.8408	1239.8434	1217.9636	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1912.1529	1828.6881	1685.6096	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	334.3047	438.1005	347.9286	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									fC = cooled area / (4) =			1120.3338	(104)
Intermittency factor (Table 10b)												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	83.5762	109.5251	86.9821	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												280.0834	(107)
Energy for space heating												1.5278	(108)
Energy for space cooling												43.5988	(99)
Energy for space cooling												1.5278	(108)
Total												45.1267	(109)
Dwelling Fabric Energy Efficiency (DFEE)												45.1	(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	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (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) = 0.0911 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3411 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2900 (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	0.3697	0.3625	0.3552	0.3190	0.3117	0.2755	0.2755	0.2682	0.2900	0.3117	0.3262	0.3407 (22b)
Effective ac	0.5683	0.5657	0.5631	0.5509	0.5486	0.5379	0.5379	0.5360	0.5420	0.5486	0.5532	0.5580 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Opening Type (Uw = 1.40)			33.9600	1.3258	45.0227		(27)
Heat Loss Floor 1			92.4600	0.1300	12.0198		(28a)
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.1800	26.7246		(29a)
External Roof 1	90.8600		90.8600	0.1300	11.8118		(30)
Bay	1.6000		1.6000	0.1300	0.2080		(30)
Total net area of external elements Aum(A, m ²)			369.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	97.9169		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.5773 (36)
Total fabric heat loss						(33) + (36) =	113.4942 (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	82.3196	81.9352	81.5585	79.7888	79.4577	77.9164	77.9164	77.6310	78.5101	79.4577	80.1275	80.8278 (38)
Heat transfer coeff	195.8138	195.4295	195.0527	193.2831	192.9520	191.4107	191.4107	191.1252	192.0044	192.9520	193.6218	194.3220 (39)
Average = Sum(39)m / 12 =												193.2815 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0682	1.0661	1.0640	1.0543	1.0525	1.0441	1.0441	1.0426	1.0474	1.0525	1.0562	1.0600 (40)
HLP (average)												1.0543 (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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4769	111.2777	107.0786	102.8794	98.6802	94.4811	94.4811	98.6802	102.8794	107.0786	111.2777	115.4769 (44)
Energy conte	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Energy content (annual)												Total = Sum(45)m = 1651.7281 (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)

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(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	(59)
Heat gains from water heating, kWh/month	36.3904	31.8273	32.8429	28.6332	27.4743	23.7082	21.9691	25.2099	25.5110	29.7306	32.4533	(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	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	149.0084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.1734	28.5761	23.2397	17.5939	13.1517	11.1032	11.9974	15.5947	20.9311	26.5768	31.0191	33.0676	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	354.9030	358.5858	349.3053	329.5482	304.6084	281.1686	265.5093	261.8266	271.1070	290.8641	315.8039	339.2437	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	37.9008	(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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	(71)
Water heating gains (Table 5)	48.9118	47.3620	44.1437	39.7684	36.9278	32.9281	29.5284	33.8843	35.4319	39.9605	45.0740	47.3685	(72)
Total internal gains	503.6907	502.2264	484.3911	454.6130	422.3904	392.9023	374.7376	379.0080	395.1726	425.1039	459.5995	487.3823	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W
North					1.7000	10.6334	0.6300	0.7000	0.7700				5.5245 (74)
Northeast					8.4500	11.2829	0.6300	0.7000	0.7700				29.1374 (75)
East					1.7000	19.6403	0.6300	0.7000	0.7700				10.2039 (76)
Southeast					1.8300	36.7938	0.6300	0.7000	0.7700				20.5778 (77)
Southwest					19.1500	36.7938	0.6300	0.7000	0.7700				215.3355 (79)
Northwest					1.1300	11.2829	0.6300	0.7000	0.7700				3.8965 (81)

Solar gains	284.6756	499.6077	721.7860	956.9790	1128.0829	1144.3733	1093.1434	961.9310	802.7672	562.5544	343.6732	241.8664	(83)
Total gains	788.3663	1001.8340	1206.1771	1411.5920	1550.4733	1537.2756	1467.8811	1340.9389	1197.9398	987.6584	803.2726	729.2487	(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	65.0136	65.1414	65.2673	65.8648	65.9778	66.5091	66.5091	66.6084	66.3035	65.9778	65.7496	65.5127		
alpha	5.3342	5.3428	5.3512	5.3910	5.3985	5.4339	5.4339	5.4406	5.4202	5.3985	5.3833	5.3675		
util living area	0.9996	0.9985	0.9940	0.9729	0.8983	0.7355	0.5615	0.6313	0.8834	0.9888	0.9990	0.9998	(86)	
MIT	19.7092	19.8835	20.1520	20.4966	20.7905	20.9507	20.9906	20.9830	20.8609	20.4627	20.0155	19.6794	(87)	
Th 2	20.0269	20.0286	20.0303	20.0383	20.0398	20.0467	20.0467	20.0480	20.0440	20.0398	20.0368	20.0336	(88)	
util rest of house	0.9995	0.9980	0.9917	0.9621	0.8590	0.6494	0.4462	0.5127	0.8231	0.9828	0.9985	0.9997	(89)	
MIT 2	18.8352	19.0106	19.2793	19.6239	19.8951	20.0236	20.0442	20.0429	19.9630	19.5961	19.1493	18.8108	(90)	
Living area fraction									fLA = Living area / (4) =			0.1372	(91)	
MIT	18.9551	19.1304	19.3991	19.7436	20.0179	20.1508	20.1741	20.1719	20.0862	19.7150	19.2681	18.9299	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9551	19.1304	19.3991	19.7436	20.0179	20.1508	20.1741	20.1719	20.0862	19.7150	19.2681	18.9299	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	0.9993	0.9973	0.9897	0.9579	0.8579	0.6595	0.4621	0.5290	0.8263	0.9800	0.9980	0.9995	(94)	
Ext temp.	787.7851	999.0896	1193.7781	1352.1118	1330.1649	1013.8780	678.3059	709.3047	989.8003	967.9519	801.6563	728.8957	(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	2869.6660	2781.0309	2515.9980	2095.8880	1604.9638	1062.4758	684.1155	720.9069	1149.3685	1758.7529	2356.0096	2862.3519	(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	1548.9194	1197.4646	983.7316	535.5189	204.4504	0.0000	0.0000	0.0000	0.0000	588.3560	1119.1344	1587.2914	(98)	
Space heating												7764.8666	(98)	
Space heating per m2												42.3569	(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	1799.2603	1416.4389	1452.5518	0.0000	0.0000	0.0000	0.0000	(100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8733	0.9329	0.9035	0.0000	0.0000	0.0000	0.0000	(101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1571.2208	1321.4624	1312.4213	0.0000	0.0000	0.0000	0.0000	(102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1933.3843	1848.9691	1703.4562	0.0000	0.0000	0.0000	0.0000	(103)	

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Month fraction	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	260.7577	392.4650	290.9300	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												944.1527 (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	65.1894	98.1162	72.7325	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												236.0382 (107)
Space cooling per m2												1.2876 (108)
Energy for space heating												42.3569 (99)
Energy for space cooling												1.2876 (108)
Total												43.6445 (109)
Target Fabric Energy Efficiency (TFEE)												50.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1139 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.3584 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3047 (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	0.3199	0.2970	0.3047	0.2894	0.2894	0.2818	0.2742	0.2666	0.2590	0.2818	0.2666	0.2818 (22b)
Effective ac	0.5512	0.5441	0.5464	0.5419	0.5419	0.5397	0.5376	0.5355	0.5335	0.5397	0.5355	0.5397 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			19.8100	1.3258	26.2633		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			92.4600	0.1500	13.8690	75.0000	6934.5000 (28a)
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.2500	37.1175	60.0000	8908.2000 (29a)
External Roof 1	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	1.6000		1.6000	0.1300	0.2080	9.0000	14.4000 (30)
Total net area of external elements Aum(A, m ²)			369.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.9460		(33)
GF			62.5600			39.0000	2439.8400 (32c)
GF			72.5200			9.0000	652.6800 (32c)
FF			188.3400			9.0000	1695.0600 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24733.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.9192 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0533 (36)
Total fabric heat loss						(33) + (36) =	122.9993 (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	79.8317	78.8109	79.1428	78.4874	78.4874	78.1723	77.8656	77.5674	77.2775	78.1723	77.5674	78.1723 (38)
Heat transfer coeff	202.8310	201.8102	202.1421	201.4867	201.4867	201.1716	200.8649	200.5667	200.2768	201.1716	200.5667	201.1716 (39)
Average = Sum(39)m / 12 =												201.2955 (39)
HLP	1.1064	1.1009	1.1027	1.0991	1.0991	1.0974	1.0957	1.0941	1.0925	1.0974	1.0941	1.0974 (40)
HLP (average)												1.0981 (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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4769	111.2777	107.0786	102.8794	98.6802	94.4811	94.4811	98.6802	102.8794	107.0786	111.2777	115.4769 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6873	22.4663	23.1832	20.2117	19.3936	16.7352	15.5076	17.7952	18.0078	20.9863	22.9082	24.8768 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (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	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (64)
Total per year (kWh/year) = Sum(64)m =												2242.9551 (64)
RHI water heating demand												2243 (64)
Heat gains from water heating, kWh/month	97.1113	86.0838	91.5605	83.6778	83.1602	75.9716	74.5463	79.6171	78.7924	86.6907	89.6550	95.3146 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.4335	71.4403	58.0991	43.9848	32.8791	27.7580	29.9935	38.9866	52.3278	66.4421	77.5478	82.6690 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	529.7059	535.2026	521.3511	491.8630	454.6395	419.6546	396.2826	390.7859	404.6374	434.1255	471.3491	506.3339 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612 (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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067 (71)
Water heating gains (Table 5)	130.5259	128.1009	123.0652	116.2191	111.7744	105.5160	100.1966	107.0122	109.4339	116.5197	124.5209	128.1111 (72)
Total internal gains	859.1298	853.2084	820.9800	770.5314	717.7576	671.3931	644.9372	655.2493	684.8635	735.5519	791.8822	835.5784 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
North				1.7000	13.4839	0.6200	0.7000		0.7700	6.8943 (74)		
Northeast				8.4500	14.6176	0.6200	0.7000		0.7700	37.1499 (75)		
East				1.7000	25.1925	0.6200	0.7000		0.7700	12.8808 (76)		
Southeast				1.8300	45.1778	0.6200	0.7000		0.7700	24.8656 (77)		
Southwest				5.0000	45.1778	0.6200	0.7000		0.7700	67.9389 (79)		
Northwest				1.1300	14.6176	0.6200	0.7000		0.7700	4.9680 (81)		
Southwest				14.1500	45.1778	0.6200	0.7000		0.7700	192.2670 (79)		
Solar gains	346.9644	519.3693	760.1187	1020.8088	1149.0955	1268.4382	1201.2994	1079.3674	895.2517	631.9462	417.7218	289.6612 (83)
Total gains	1206.0942	1372.5777	1581.0987	1791.3402	1866.8531	1939.8313	1846.2366	1734.6167	1580.1152	1367.4981	1209.6040	1125.2396 (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	33.8724	34.0438	33.9879	34.0984	34.0984	34.1519	34.2040	34.2549	34.3044	34.1519	34.2549	34.1519
alpha	3.2582	3.2696	3.2659	3.2732	3.2732	3.2768	3.2803	3.2837	3.2870	3.2768	3.2837	3.2768
util living area	0.9751	0.9622	0.9281	0.8535	0.7320	0.5429	0.4092	0.4322	0.6744	0.8779	0.9562	0.9790 (86)
MIT	19.2958	19.4906	19.8875	20.3558	20.7171	20.9235	20.9773	20.9734	20.8394	20.4025	19.7961	19.2688 (87)
Th 2	19.9956	20.0001	19.9987	20.0016	20.0016	20.0030	20.0043	20.0057	20.0070	20.0030	20.0057	20.0030 (88)
util rest of house	0.9703	0.9551	0.9144	0.8253	0.6797	0.4628	0.3110	0.3297	0.5995	0.8472	0.9464	0.9749 (89)
MIT 2	17.7361	18.0192	18.5854	19.2384	19.7113	19.9451	19.9933	19.9926	19.8683	19.3178	18.4673	17.7021 (90)
Living area fraction	17.9501	18.2210	18.7640	19.3917	19.8493	20.0793	20.1283	20.1272	20.0015	19.4666	18.6496	17.9170 (92)
MIT	17.9501	18.2210	18.7640	19.3917	19.8493	20.0793	20.1283	20.1272	20.0015	19.4666	18.6496	17.9170 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8001	18.0710	18.6140	19.2417	19.6993	19.9293	19.9783	19.9772	19.8515	19.3166	18.4996	17.7670 (93)

8. Space heating requirement

Utilisation	0.9551	0.9361	0.8898	0.7997	0.6620	0.4565	0.3083	0.3266	0.5864	0.8208	0.9257	0.9613 (94)
Useful gains	1151.9565	1284.8525	1406.8604	1432.5554	1235.8910	885.5749	569.2854	566.5982	926.6246	1122.5104	1119.7390	1081.6504 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Month fracti	2616.5340	2577.3264	2347.6809	1962.8288	1450.5562	931.2851	578.1544	577.0686	1031.7301	1592.5936	2125.9244	2568.3578 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1089.6456	868.5425	699.9704	381.7968	159.7109	0.0000	0.0000	0.0000	0.0000	349.7419	724.4535	1106.1103 (98)
RHI space heating demand												5379.9719 (98)
												5380 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1139 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.3584 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3047 (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	0.3884	0.3808	0.3732	0.3351	0.3275	0.2894	0.2894	0.2818	0.3047	0.3275	0.3427	0.3580 (22b)
Effective ac	0.5754	0.5725	0.5696	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5587	0.5641 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			19.8100	1.3258	26.2633		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			92.4600	0.1500	13.8690	75.0000	6934.5000 (28a)
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.2500	37.1175	60.0000	8908.2000 (29a)
External Roof 1	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	1.6000		1.6000	0.1300	0.2080	9.0000	14.4000 (30)
Total net area of external elements Aum(A, m ²)			369.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.9460		(33)
GF			62.5600			39.0000	2439.8400 (32c)
GF			72.5200			9.0000	652.6800 (32c)
FF			188.3400			9.0000	1695.0600 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24733.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.9192 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0533 (36)
Total fabric heat loss						(33) + (36) =	122.9993 (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	83.3480	82.9237	82.5078	80.5543	80.1888	78.4874	78.4874	78.1723	79.1428	80.1888	80.9282	81.7012 (38)
Heat transfer coeff	206.3473	205.9230	205.5071	203.5536	203.1881	201.4867	201.4867	201.1716	202.1421	203.1881	203.9275	204.7005 (39)
Average = Sum(39)m / 12 =												203.5519 (39)
HLP	1.1256	1.1233	1.1210	1.1104	1.1084	1.0991	1.0991	1.0974	1.1027	1.1084	1.1124	1.1166 (40)
HLP (average)												1.1104 (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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4769	111.2777	107.0786	102.8794	98.6802	94.4811	94.4811	98.6802	102.8794	107.0786	111.2777	115.4769 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6873	22.4663	23.1832	20.2117	19.3936	16.7352	15.5076	17.7952	18.0078	20.9863	22.9082	24.8768 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (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	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (64)
Heat gains from water heating, kWh/month	97.1113	86.0838	91.5605	83.6778	83.1602	75.9716	74.5463	79.6171	78.7924	86.6907	89.6550	95.3146 (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	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.4335	71.4403	58.0991	43.9848	32.8791	27.7580	29.9935	38.9866	52.3278	66.4421	77.5478	82.6690 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	529.7059	535.2026	521.3511	491.8630	454.6395	419.6546	396.2826	390.7859	404.6374	434.1255	471.3491	506.3339 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612 (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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067 (71)
Water heating gains (Table 5)	130.5259	128.1009	123.0652	116.2191	111.7744	105.5160	100.1966	107.0122	109.4339	116.5197	124.5209	128.1111 (72)
Total internal gains	859.1298	853.2084	820.9800	770.5314	717.7576	671.3931	644.9372	655.2493	684.8635	735.5519	791.8822	835.5784 (73)

6. Solar gains

[Jan]													
				Area		Solar flux		g		FF		Access	Gains
				m2		Table 6a		Specific data		Specific data		factor	W
						W/m2		or Table 6b		or Table 6c		Table 6d	
North				1.7000		10.6334		0.6200		0.7000		0.7700	5.4368 (74)
Northeast				8.4500		11.2829		0.6200		0.7000		0.7700	28.6749 (75)
East				1.7000		19.6403		0.6200		0.7000		0.7700	10.0420 (76)
Southeast				1.8300		36.7938		0.6200		0.7000		0.7700	20.2511 (77)
Southwest				5.0000		36.7938		0.6200		0.7000		0.7700	55.3309 (79)
Northwest				1.1300		11.2829		0.6200		0.7000		0.7700	3.8346 (81)
Southwest				14.1500		36.7938		0.6200		0.7000		0.7700	156.5865 (79)
Solar gains	280.1569	491.6774	710.3291	941.7889	1110.1769	1126.2086	1075.7920	946.6622	790.0249	553.6250	338.2180	238.0273	(83)
Total gains	1139.2868	1344.8857	1531.3091	1712.3203	1827.9344	1797.6017	1720.7291	1601.9115	1474.8884	1289.1769	1130.1002	1073.6057	(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	33.2952	33.3638	33.4314	33.7522	33.8129	34.0984	34.0984	34.1519	33.9879	33.8129	33.6903	33.5631
alpha	3.2197	3.2243	3.2288	3.2501	3.2542	3.2732	3.2732	3.2768	3.2659	3.2542	3.2460	3.2375
util living area	0.9809	0.9669	0.9397	0.8811	0.7775	0.6272	0.4849	0.5330	0.7438	0.9110	0.9690	0.9840 (86)
MIT	19.1114	19.3646	19.7487	20.2227	20.6181	20.8675	20.9574	20.9415	20.7569	20.2349	19.5837	19.0626 (87)
Th 2	19.9800	19.9819	19.9837	19.9924	19.9940	20.0016	20.0016	20.0030	19.9987	19.9940	19.9907	19.9873 (88)
util rest of house	0.9772	0.9607	0.9282	0.8577	0.7330	0.5531	0.3863	0.4334	0.6788	0.8885	0.9621	0.9810 (89)
MIT 2	17.4590	17.8259	18.3784	19.0508	19.5816	19.8889	19.9768	19.9664	19.7699	19.0827	18.1526	17.3927 (90)
Living area fraction	17.6857	18.0370	18.5664	19.2116	19.7238	20.0232	20.1114	20.1002	19.9053	19.2408	18.3490	17.6218 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5357	17.8870	18.4164	19.0616	19.5738	19.8732	19.9614	19.9502	19.7553	19.0908	18.1990	17.4718 (93)

8. Space heating requirement

Utilisation	0.9642	0.9427	0.9046	0.8312	0.7117	0.5427	0.3821	0.4278	0.6606	0.8622	0.9446	0.9695 (94)
Useful gains	1098.4899	1267.7792	1385.2533	1423.3349	1300.9034	975.5808	657.4910	685.2310	974.3541	1111.4733	1067.4485	1040.8219 (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	2731.1560	2674.3270	2448.9014	2068.4234	1599.8636	1062.4732	677.2690	714.1924	1143.1807	1725.2234	2263.3828	2716.7474 (97)

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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	1214.7036	945.2001	791.3542	464.4637	222.4264	0.0000	0.0000	0.0000	0.0000	456.6301	861.0727	1246.8886 (98)
Space heating												6202.7393 (98)
Space heating per m2										(98) / (4) =		33.8356 (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 %)												90.2000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6876.6512 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1214.7036	945.2001	791.3542	464.4637	222.4264	0.0000	0.0000	0.0000	0.0000	456.6301	861.0727	1246.8886 (98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)
Space heating fuel (main heating system)	1346.6780	1047.8937	877.3328	514.9265	246.5925	0.0000	0.0000	0.0000	0.0000	506.2418	954.6260	1382.3598 (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	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (64)
Efficiency of water heater (217)m	88.3660	88.1694	87.7716	86.8902	85.0856	79.5000	79.5000	79.5000	79.5000	86.7671	87.9567	79.5000 (216)
Fuel for water heating, kWh/month	250.6198	221.3124	233.2971	211.0002	210.9693	201.4616	193.2050	212.3882	212.1329	219.1183	228.8798	244.2948 (219)
Water heating fuel used												2638.6793 (219)
Annual totals kWh/year												
Space heating fuel - main system												6876.6512 (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)												568.1920 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.08 * 1029 * 1.00) =										-889.2173		-889.2173 (233)
Total delivered energy for all uses												9269.3051 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6876.6512	3.4800	239.3075 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2638.6793	3.4800	91.8260 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	568.1920	13.1900	74.9445 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-889.2173	13.1900	-117.2878 (252)
Total energy cost			418.6828 (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] =	0.7702 (257)
SAP value		89.2560
SAP rating (Section 12)		89 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6876.6512	0.2160	1485.3567 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2638.6793	0.2160	569.9547 (264)
Space and water heating			2055.3114 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	568.1920	0.5190	294.8916 (268)
Energy saving/generation technologies			
PV Unit	-889.2173	0.5190	-461.5038 (269)
Total kg/year			1927.6242 (272)

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CO2 emissions per m2	10.5200 (273)
EI value	88.6869
EI rating	89 (274)
EI band	B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8479 = 4.104$, stars = 4
Water heating environmental impact	$0.216 / 0.8479 = 0.2548$, 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	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																5 * 10 =	50.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000	/ (5) =	0.1139 (8)
Pressure test										Yes							
Measured/design AP50										4.8900							
Infiltration rate										0.3584 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3047 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.3199	0.2970	0.3047	0.2894	0.2894	0.2818	0.2742	0.2666	0.2590	0.2818	0.2666	0.2818	(22b)				
Effective ac	0.5512	0.5441	0.5464	0.5419	0.5419	0.5397	0.5376	0.5355	0.5335	0.5397	0.5355	0.5397	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			2.1300	0.9000	1.9170			(26)					
Window (Uw = 1.40)			19.8100	1.3258	26.2633			(27)					
French (Uw = 1.40)			14.1500	1.3258	18.7595			(27)					
Heat Loss Floor 1			92.4600	0.1500	13.8690	75.0000	6934.5000	(28a)					
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.2500	37.1175	60.0000	8908.2000	(29a)					
External Roof 1	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400	(30)					
Bay	1.6000		1.6000	0.1300	0.2080	9.0000	14.4000	(30)					
Total net area of external elements Aum(A, m2)			369.4800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.9460			(33)					
GF			62.5600			39.0000	2439.8400	(32c)					
GF			72.5200			9.0000	652.6800	(32c)					
FF			188.3400			9.0000	1695.0600	(32c)					
Internal Floor 1			90.8600			18.0000	1635.4800	(32d)					
Internal Floor 1			90.8600			18.0000	1635.4800	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24733.3800	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							134.9192	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0533	(36)					
Total fabric heat loss						(33) + (36) =	122.9993	(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	79.8317	78.8109	79.1428	78.4874	78.4874	78.1723	77.8656	77.5674	77.2775	78.1723	77.5674	78.1723	(38)
Heat transfer coeff	202.8310	201.8102	202.1421	201.4867	201.4867	201.1716	200.8649	200.5667	200.2768	201.1716	200.5667	201.1716	(39)
Average = Sum(39)m / 12 =												201.2955	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1064	1.1009	1.1027	1.0991	1.0991	1.0974	1.0957	1.0941	1.0925	1.0974	1.0941	1.0974	(40)
HLP (average)												1.0981	(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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
Daily hot water use	Jan 115.4769	Feb 111.2777	Mar 107.0786	Apr 102.8794	May 98.6802	Jun 94.4811	Jul 94.4811	Aug 98.6802	Sep 102.8794	Oct 107.0786	Nov 111.2777	Dec 115.4769 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6873	22.4663	23.1832	20.2117	19.3936	16.7352	15.5076	17.7952	18.0078	20.9863	22.9082	24.8768 (46)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (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	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592 (64)
Heat gains from water heating, kWh/month	97.1113	86.0838	91.5605	83.6778	83.1602	75.9716	74.5463	79.6171	78.7924	86.6907	89.6550	95.3146 (65)
Total per year (kWh/year) = Sum(64)m =												2242.9551 (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	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.4335	71.4403	58.0991	43.9848	32.8791	27.7580	29.9935	38.9866	52.3278	66.4421	77.5478	82.6690 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	529.7059	535.2026	521.3511	491.8630	454.6395	419.6546	396.2826	390.7859	404.6374	434.1255	471.3491	506.3339 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612 (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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067 (71)
Water heating gains (Table 5)	130.5259	128.1009	123.0652	116.2191	111.7744	105.5160	100.1966	107.0122	109.4339	116.5197	124.5209	128.1111 (72)
Total internal gains	859.1298	853.2084	820.9800	770.5314	717.7576	671.3931	644.9372	655.2493	684.8635	735.5519	791.8822	835.5784 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
North				1.7000	13.4839	0.6200	0.7000		0.7700	6.8943 (74)		
Northeast				8.4500	14.6176	0.6200	0.7000		0.7700	37.1499 (75)		
East				1.7000	25.1925	0.6200	0.7000		0.7700	12.8808 (76)		
Southeast				1.8300	45.1778	0.6200	0.7000		0.7700	24.8656 (77)		
Southwest				5.0000	45.1778	0.6200	0.7000		0.7700	67.9389 (79)		
Northwest				1.1300	14.6176	0.6200	0.7000		0.7700	4.9680 (81)		
Southwest				14.1500	45.1778	0.6200	0.7000		0.7700	192.2670 (79)		
Solar gains	346.9644	519.3693	760.1187	1020.8088	1149.0955	1268.4382	1201.2994	1079.3674	895.2517	631.9462	417.7218	289.6612 (83)
Total gains	1206.0942	1372.5777	1581.0987	1791.3402	1866.8531	1939.8313	1846.2366	1734.6167	1580.1152	1367.4981	1209.6040	1125.2396 (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	33.8724	34.0438	33.9879	34.0984	34.0984	34.1519	34.2040	34.2549	34.3044	34.1519	34.2549	34.1519
alpha	3.2582	3.2696	3.2659	3.2732	3.2732	3.2768	3.2803	3.2837	3.2870	3.2768	3.2837	3.2768
util living area	0.9751	0.9622	0.9281	0.8535	0.7320	0.5429	0.4092	0.4322	0.6744	0.8779	0.9562	0.9790 (86)
MIT	19.2958	19.4906	19.8875	20.3558	20.7171	20.9235	20.9773	20.9734	20.8394	20.4025	19.7961	19.2688 (87)
Th 2	19.9956	20.0001	19.9987	20.0016	20.0016	20.0030	20.0043	20.0057	20.0070	20.0030	20.0057	20.0030 (88)
util rest of house	0.9703	0.9551	0.9144	0.8253	0.6797	0.4628	0.3110	0.3297	0.5995	0.8472	0.9464	0.9749 (89)
MIT 2	17.7361	18.0192	18.5854	19.2384	19.7113	19.9451	19.9933	19.9926	19.8683	19.3178	18.4673	17.7021 (90)
Living area fraction									fLA = Living area / (4) =			0.1372 (91)
MIT	17.9501	18.2210	18.7640	19.3917	19.8493	20.0793	20.1283	20.1272	20.0015	19.4666	18.6496	17.9170 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8001	18.0710	18.6140	19.2417	19.6993	19.9293	19.9783	19.9772	19.8515	19.3166	18.4996	17.7670 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9551	0.9361	0.8898	0.7997	0.6620	0.4565	0.3083	0.3266	0.5864	0.8208	0.9257	0.9613 (94)
Ext temp.	1151.9565	1284.8525	1406.8604	1432.5554	1235.8910	885.5749	569.2854	566.5982	926.6246	1122.5104	1119.7390	1081.6504 (95)
Heat loss rate W	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)
	2616.5340	2577.3264	2347.6809	1962.8288	1450.5562	931.2851	578.1544	577.0686	1031.7301	1592.5936	2125.9244	2568.3578 (97)

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Month fraction	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1089.6456	868.5425	699.9704	381.7968	159.7109	0.0000	0.0000	0.0000	0.0000	349.7419	724.4535	1106.1103	(98)
Space heating requirement												5379.9719	(98)
Space heating per m2												29.3474	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													5964.4922	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1089.6456	868.5425	699.9704	381.7968	159.7109	0.0000	0.0000	0.0000	0.0000	349.7419	724.4535	1106.1103	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	1208.0328	962.9074	776.0204	423.2781	177.0631	0.0000	0.0000	0.0000	0.0000	387.7405	803.1635	1226.2863	(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	221.4627	195.1298	204.7686	183.3386	179.5044	160.1620	153.5979	168.8486	168.6457	190.1225	201.3152	216.0592	(64)	
Efficiency of water heater (217)m	88.1950	88.0266	87.5336	86.4263	84.2029	79.5000	79.5000	79.5000	79.5000	86.1181	87.6351	79.5000	(216)	
Fuel for water heating, kWh/month	251.1058	221.6714	233.9315	212.1328	213.1809	201.4616	193.2050	212.3882	212.1329	220.7694	229.7199	244.8017	(219)	
Water heating fuel used												2646.5011	(219)	
Annual totals kWh/year														
Space heating fuel - main system												5964.4922	(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)												568.1920	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 1.08 * 1156 * 1.00) =										-998.9833		-998.9833	(233)	
Total delivered energy for all uses												8255.2019	(238)	

10a. Fuel costs - using BEDF prices (443)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5964.4922	3.9200	233.8081	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2646.5011	3.9200	103.7428	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	568.1920	16.9600	96.3654	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-998.9833	16.9600	-169.4276	(252)
Total energy cost			365.2087	(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	5964.4922	0.2160	1288.3303	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2646.5011	0.2160	571.6442	(264)
Space and water heating			1859.9745	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	568.1920	0.5190	294.8916	(268)
Energy saving/generation technologies				
PV Unit	-998.9833	0.5190	-518.4723	(269)
Total kg/year			1675.3188	(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	5964.4922	1.2200	7276.6804	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2646.5011	1.2200	3228.7313	(264)

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Space and water heating			10505.4117 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	568.1920	3.0700	1744.3494 (268)
Energy saving/generation technologies			
PV Unit	-998.9833	3.0700	-3066.8788 (269)
Primary energy kWh/year			9413.1324 (272)
Primary energy kWh/m2/year			51.3481 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 45	-269 kg (16.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£45 1.47 kg/m²	B 90	B 90
Total Savings	£45 1.47 kg/m²		

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

Fuel prices for cost data on this page from database revision number 443 TEST (28 May 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	£109	£118	-£8
Mains gas	£426	£372	£54
Space heating	£335	£336	-£1
Water heating	£104	£57	£46
Lighting	£96	£96	£0
Generated (PV)	-£169	-£169	£0
Total cost of fuels	£366	£321	£46
Total cost of uses	£366	£320	£45
Delivered energy	45 kWh/m²	38 kWh/m²	7 kWh/m²
Carbon dioxide emissions	1.7 tonnes	1.4 tonnes	0.3 tonnes
CO2 emissions per m²	9 kg/m²	8 kg/m²	1 kg/m²
Primary energy	51 kWh/m²	43 kWh/m²	8 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1139 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.3584 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3047 (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	0.3884	0.3808	0.3732	0.3351	0.3275	0.2894	0.2894	0.2818	0.3047	0.3275	0.3427	0.3580 (22b)
Effective ac	0.5754	0.5725	0.5696	0.5562	0.5536	0.5419	0.5419	0.5397	0.5464	0.5536	0.5587	0.5641 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			19.8100	1.3258	26.2633		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			92.4600	0.1500	13.8690	75.0000	6934.5000 (28a)
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.2500	37.1175	60.0000	8908.2000 (29a)
External Roof 1	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	1.6000		1.6000	0.1300	0.2080	9.0000	14.4000 (30)
Total net area of external elements Aum(A, m ²)			369.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.9460		(33)
GF			62.5600			39.0000	2439.8400 (32c)
GF			72.5200			9.0000	652.6800 (32c)
FF			188.3400			9.0000	1695.0600 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24733.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.9192 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0533 (36)
Total fabric heat loss						(33) + (36) =	122.9993 (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	83.3480	82.9237	82.5078	80.5543	80.1888	78.4874	78.4874	78.1723	79.1428	80.1888	80.9282	81.7012 (38)
Heat transfer coeff	206.3473	205.9230	205.5071	203.5536	203.1881	201.4867	201.4867	201.1716	202.1421	203.1881	203.9275	204.7005 (39)
Average = Sum(39)m / 12 =												203.5519 (39)
HLP	1.1256	1.1233	1.1210	1.1104	1.1084	1.0991	1.0991	1.0974	1.1027	1.1084	1.1124	1.1166 (40)
HLP (average)												1.1104 (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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4769	111.2777	107.0786	102.8794	98.6802	94.4811	94.4811	98.6802	102.8794	107.0786	111.2777	115.4769 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6873	22.4663	23.1832	20.2117	19.3936	16.7352	15.5076	17.7952	18.0078	20.9863	22.9082	1651.7281 (45)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	18.8660	17.0402	18.8660	18.2574	18.8660	18.2574	18.8660	18.8660	18.2574	18.8660	18.2574	18.8660 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.3773	187.8268	195.2874	168.7604	158.6247	139.7307	132.4856	148.6667	155.4182	180.6413	193.4906	207.9738 (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												1.0980 (H8)
Utilisation factor												0.5978 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.9790 (H14)
Volume ratio Veff/V												1.2145 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-953.2653 (H17)
Solar input	-27.6428	-46.1279	-78.5610	-105.2873	-130.0736	-127.8830	-126.1930	-110.2555	-86.3521	-58.9684	-32.7883	-23.1323 (63)
Solar input (sum of months) = Sum(63)m =												-953.2653 (63)
Output from w/h	185.7345	141.6989	116.7263	63.4731	28.5511	11.8476	6.2926	38.4113	69.0661	121.6729	160.7023	184.8415 (64)
Total per year (kWh/year) = Sum(64)m =												1129.0181 (64)
Heat gains from water heating, kWh/month	90.6430	80.2415	83.9756	72.0152	66.4564	59.6265	57.6564	63.4716	68.2104	79.1057	83.3953	88.8463 (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	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.4335	71.4403	58.0991	43.9848	32.8791	27.7580	29.9935	38.9866	52.3278	66.4421	77.5478	82.6690	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	529.7059	535.2026	521.3511	491.8630	454.6395	419.6546	396.2826	390.7859	404.6374	434.1255	471.3491	506.3339	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	(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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	(71)
Water heating gains (Table 5)	121.8319	119.4069	112.8704	100.0211	89.3231	82.8146	77.4951	85.3113	94.7367	106.3249	115.8269	119.4171	(72)
Total internal gains	850.4358	844.5144	810.7852	754.3334	695.3062	648.6917	622.2357	633.5484	670.1663	725.3571	783.1882	826.8844	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.7000	10.6334		0.6200	0.7000	0.7700		5.4368 (74)	
Northeast					8.4500	11.2829		0.6200	0.7000	0.7700		28.6749 (75)	
East					1.7000	19.6403		0.6200	0.7000	0.7700		10.0420 (76)	
Southeast					1.8300	36.7938		0.6200	0.7000	0.7700		20.2511 (77)	
Southwest					5.0000	36.7938		0.6200	0.7000	0.7700		55.3309 (79)	
Northwest					1.1300	11.2829		0.6200	0.7000	0.7700		3.8346 (81)	
Southwest					14.1500	36.7938		0.6200	0.7000	0.7700		156.5865 (79)	
Solar gains	280.1569	491.6774	710.3291	941.7889	1110.1769	1126.2086	1075.7920	946.6622	790.0249	553.6250	338.2180	238.0273	(83)
Total gains	1130.5928	1336.1917	1521.1143	1696.1223	1805.4831	1774.9003	1698.0276	1580.2106	1460.1912	1278.9821	1121.4062	1064.9117	(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	33.2952	33.3638	33.4314	33.7522	33.8129	34.0984	34.0984	34.1519	33.9879	33.8129	33.6903	33.5631	
alpha	3.2197	3.2243	3.2288	3.2501	3.2542	3.2732	3.2732	3.2768	3.2659	3.2542	3.2460	3.2375	
util living area	0.9813	0.9674	0.9407	0.8835	0.7821	0.6328	0.4904	0.5388	0.7477	0.9126	0.9696	0.9844	(86)
MIT	19.1049	19.3584	19.7421	20.2143	20.6107	20.8640	20.9560	20.9396	20.7527	20.2290	19.5775	19.0560	(87)
Th 2	19.9800	19.9819	19.9837	19.9924	19.9940	20.0016	20.0016	20.0030	19.9987	19.9940	19.9907	19.9873	(88)
util rest of house													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT 2	0.9777	0.9613	0.9294	0.8604	0.7379	0.5586	0.3910	0.4387	0.6830	0.8904	0.9629	0.9814 (89)
Living area fraction	17.4496	17.8170	18.3692	19.0397	19.5727	19.8856	19.9759	19.9651	19.7655	19.0748	18.1437	17.3831 (90)
MIT	17.6767	18.0285	18.5575	19.2008	19.7151	20.0198	20.1104	20.0988	fLA = Living area / (4) =			0.1372 (91)
Temperature adjustment									19.9009	19.2331	18.3404	17.6126 (92)
adjusted MIT	17.5267	17.8785	18.4075	19.0508	19.5651	19.8698	19.9604	19.9488	19.7509	19.0831	18.1904	-0.1500
												17.4626 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9648	0.9435	0.9059	0.8339	0.7163	0.5479	0.3867	0.4328	0.6646	0.8641	0.9455	0.9701 (94)	
Useful gains	1090.8389	1260.6745	1377.9445	1414.4203	1293.3248	972.4845	656.5950	683.9442	970.4733	1105.1926	1060.3015	1033.0330 (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	2729.2865	2672.5723	2447.0821	2066.2384	1598.0890	1061.7941	677.0732	713.9111	1142.2874	1723.6719	2261.6301	2714.8622 (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	1219.0050	948.7953	795.4384	469.3090	226.7446	0.0000	0.0000	0.0000	0.0000	460.1486	864.9566	1251.2809 (98)	
Space heating												6235.6783 (98)	
Space heating per m2												(98) / (4) =	34.0153 (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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													6913.1689 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1219.0050	948.7953	795.4384	469.3090	226.7446	0.0000	0.0000	0.0000	0.0000	460.1486	864.9566	1251.2809 (98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)	
Space heating fuel (main heating system)	1351.4467	1051.8795	881.8607	520.2983	251.3798	0.0000	0.0000	0.0000	0.0000	510.1426	958.9319	1387.2294 (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	185.7345	141.6989	116.7263	63.4731	28.5511	11.8476	6.2926	38.4113	69.0661	121.6729	160.7023	184.8415 (64)	
Efficiency of water heater (217)m	88.6229	88.6496	88.6728	88.7765	88.8624	79.5000	79.5000	79.5000	79.5000	87.7307	88.3371	79.5000 (216)	
Fuel for water heating, kWh/month	209.5784	159.8415	131.6372	71.4976	32.1296	14.9027	7.9152	48.3161	86.8755	138.6891	181.9193	208.4739 (219)	
Water heating fuel used												1291.7761 (219)	
Annual totals kWh/year													
Space heating fuel - main system												6913.1689 (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)												568.1920 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.08 * 1029 * 1.00) =										-889.2173		-889.2173 (233)	
Total delivered energy for all uses												8008.9196 (238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	6913.1689	3.4800	240.5783 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1291.7761	3.4800	44.9538 (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	568.1920	13.1900	74.9445 (250)	
Additional standing charges			120.0000 (251)	
Energy saving/generation technologies				
PV Unit	-889.2173	13.1900	-117.2878 (252)	
Total energy cost			379.6763 (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] =	0.6984 (257)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP value 90.2570
 SAP rating (Section 12) 90 (258)
 SAP band B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6913.1689	0.2160	1493.2445 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.7761	0.2160	279.0236 (264)
Space and water heating			1772.2681 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	568.1920	0.5190	294.8916 (268)
Energy saving/generation technologies			
PV Unit	-889.2173	0.5190	-461.5038 (269)
Total kg/year			1670.5310 (272)
CO2 emissions per m2			9.1100 (273)
EI value			90.1957
EI rating			90 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	92.4600 (1b)	x 2.3100 (2b)	= 213.5826 (1b) - (3b)
First floor	90.8600 (1c)	x 2.4800 (2c)	= 225.3328 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	183.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 438.9154 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1139 (8)
Pressure test					Yes
Measured/design AP50					4.8900
Infiltration rate					0.3584 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3047 (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	0.3199	0.2970	0.3047	0.2894	0.2894	0.2818	0.2742	0.2666	0.2590	0.2818	0.2666	0.2818 (22b)
Effective ac	0.5512	0.5441	0.5464	0.5419	0.5419	0.5397	0.5376	0.5355	0.5335	0.5397	0.5355	0.5397 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			19.8100	1.3258	26.2633		(27)
French (Uw = 1.40)			14.1500	1.3258	18.7595		(27)
Heat Loss Floor 1			92.4600	0.1500	13.8690	75.0000	6934.5000 (28a)
100mm Knauf Supafil	184.5600	36.0900	148.4700	0.2500	37.1175	60.0000	8908.2000 (29a)
External Roof 1	90.8600		90.8600	0.1300	11.8118	9.0000	817.7400 (30)
Bay	1.6000		1.6000	0.1300	0.2080	9.0000	14.4000 (30)
Total net area of external elements Aum(A, m ²)			369.4800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.9460		(33)
GF			62.5600			39.0000	2439.8400 (32c)
GF			72.5200			9.0000	652.6800 (32c)
FF			188.3400			9.0000	1695.0600 (32c)
Internal Floor 1			90.8600			18.0000	1635.4800 (32d)
Internal Floor 1			90.8600			18.0000	1635.4800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24733.3800 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							134.9192 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.0533 (36)
Total fabric heat loss						(33) + (36) =	122.9993 (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	79.8317	78.8109	79.1428	78.4874	78.4874	78.1723	77.8656	77.5674	77.2775	78.1723	77.5674	78.1723 (38)
Heat transfer coeff	202.8310	201.8102	202.1421	201.4867	201.4867	201.1716	200.8649	200.5667	200.2768	201.1716	200.5667	201.1716 (39)
Average = Sum(39)m / 12 =												201.2955 (39)
HLP	1.1064	1.1009	1.1027	1.0991	1.0991	1.0974	1.0957	1.0941	1.0925	1.0974	1.0941	1.0974 (40)
HLP (average)												1.0981 (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												2.9802 (42)
Average daily hot water use (litres/day)												104.9790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.4769	111.2777	107.0786	102.8794	98.6802	94.4811	94.4811	98.6802	102.8794	107.0786	111.2777	115.4769 (44)

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)	171.2489	149.7754	154.5548	134.7446	129.2906	111.5680	103.3841	118.6348	120.0517	139.9087	152.7212	165.8454 (45)
Distribution loss (46)m = 0.15 x (45)m	25.6873	22.4663	23.1832	20.2117	19.3936	16.7352	15.5076	17.7952	18.0078	20.9863	22.9082	1651.7281 (45)
Water storage loss:												
Store volume												250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.6100 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8694 (55)
Total storage loss	26.9514	24.3432	26.9514	26.0820	26.9514	26.0820	26.9514	26.9514	26.0820	26.9514	26.0820	26.9514 (56)
If cylinder contains dedicated solar storage	18.8660	17.0402	18.8660	18.2574	18.8660	18.2574	18.8660	18.8660	18.2574	18.8660	18.2574	18.8660 (57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month	213.3773	187.8268	195.2874	168.7604	158.6247	139.7307	132.4856	148.6667	155.4182	180.6413	193.4906	207.9738 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2288 (H8)
Utilisation factor												0.5568 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												127.5000 (H13)
Daily hot water demand												104.9790 (H14)
Volume ratio Veff/V												1.2145 (H15)
Solar storage volume factor												1.0000 (H16)
Solar input												-993.7567 (H17)
Solar input	-32.4187	-46.0974	-79.2303	-106.9001	-125.5606	-134.1185	-131.2980	-117.5157	-92.0067	-63.6103	-38.3428	-26.6576 (63)
Solar input (sum of months) = Sum(63)m =												-993.7567 (63)
Output from w/h	180.9585	141.7294	116.0570	61.8603	33.0641	5.6121	1.1876	31.1511	63.4115	117.0310	155.1478	181.3161 (64)
Total per year (kWh/year) = Sum(64)m =												1088.5266 (64)
Heat gains from water heating, kWh/month	90.6430	80.2415	83.9756	72.0152	66.4564	59.6265	57.6564	63.4716	68.2104	79.1057	83.3953	88.8463 (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	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	178.8100	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	80.4335	71.4403	58.0991	43.9848	32.8791	27.7580	29.9935	38.9866	52.3278	66.4421	77.5478	82.6690	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	529.7059	535.2026	521.3511	491.8630	454.6395	419.6546	396.2826	390.7859	404.6374	434.1255	471.3491	506.3339	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	55.8612	(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)	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	-119.2067	(71)
Water heating gains (Table 5)	121.8319	119.4069	112.8704	100.0211	89.3231	82.8146	77.4951	85.3113	94.7367	106.3249	115.8269	119.4171	(72)
Total internal gains	850.4358	844.5144	810.7852	754.3334	695.3062	648.6917	622.2357	633.5484	670.1663	725.3571	783.1882	826.8844	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				1.7000	13.4839	0.6200	0.7000		0.7700		6.8943 (74)	
Northeast				8.4500	14.6176	0.6200	0.7000		0.7700		37.1499 (75)	
East				1.7000	25.1925	0.6200	0.7000		0.7700		12.8808 (76)	
Southeast				1.8300	45.1778	0.6200	0.7000		0.7700		24.8656 (77)	
Southwest				5.0000	45.1778	0.6200	0.7000		0.7700		67.9389 (79)	
Northwest				1.1300	14.6176	0.6200	0.7000		0.7700		4.9680 (81)	
Southwest				14.1500	45.1778	0.6200	0.7000		0.7700		192.2670 (79)	
Solar gains	346.9644	519.3693	760.1187	1020.8088	1149.0955	1268.4382	1201.2994	1079.3674	895.2517	631.9462	417.7218	289.6612 (83)
Total gains	1197.4002	1363.8837	1570.9039	1775.1422	1844.4017	1917.1299	1823.5351	1712.9158	1565.4180	1357.3033	1200.9100	1116.5456 (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	33.8724	34.0438	33.9879	34.0984	34.0984	34.1519	34.2040	34.2549	34.3044	34.1519	34.2549	34.1519
alpha	3.2582	3.2696	3.2659	3.2732	3.2732	3.2768	3.2803	3.2837	3.2870	3.2768	3.2837	3.2768
util living area												
	0.9756	0.9628	0.9292	0.8561	0.7368	0.5479	0.4138	0.4371	0.6784	0.8798	0.9570	0.9794 (86)
MIT	19.2894	19.4844	19.8812	20.3483	20.7110	20.9213	20.9765	20.9725	20.8365	20.3973	19.7901	19.2622 (87)
Th 2	19.9956	20.0001	19.9987	20.0016	20.0016	20.0030	20.0043	20.0057	20.0070	20.0030	20.0057	20.0030 (88)
util rest of house												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

MIT 2	0.9709	0.9558	0.9157	0.8283	0.6849	0.4675	0.3147	0.3337	0.6036	0.8495	0.9473	0.9754 (89)
Living area fraction	17.7268	18.0104	18.5766	19.2287	19.7044	19.9433	19.9929	19.9922	19.8654	19.3111	18.4588	17.6926 (90)
MIT	17.9412	18.2127	18.7556	19.3823	19.8425	20.0775	20.1279	20.1267	fLA = Living area / (4) =			0.1372 (91)
Temperature adjustment									19.9986	19.4601	18.6415	17.9080 (92)
adjusted MIT	17.7912	18.0627	18.6056	19.2323	19.6925	19.9275	19.9779	19.9767	19.8486	19.3101	18.4915	-0.1500
												17.7580 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9559	0.9370	0.8912	0.8026	0.6668	0.4610	0.3120	0.3305	0.5903	0.8231	0.9268	0.9620 (94)	
Useful gains	1144.5493	1277.9195	1399.9395	1424.6836	1229.9293	883.8890	568.8832	566.1217	924.0366	1117.1385	1113.0533	1074.0872 (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	2614.7348	2575.6339	2345.9778	1960.9334	1449.1977	930.9229	578.0652	576.9629	1031.1544	1591.2881	2124.2932	2566.5380 (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	1093.8180	872.0640	703.8525	386.0998	163.1357	0.0000	0.0000	0.0000	0.0000	352.7673	728.0927	1110.3834 (98)	
Space heating												5410.2135 (98)	
Space heating per m2												(98) / (4) =	29.5124 (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 %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5998.0194 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1093.8180	872.0640	703.8525	386.0998	163.1357	0.0000	0.0000	0.0000	0.0000	352.7673	728.0927	1110.3834 (98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000 (210)	
Space heating fuel (main heating system)	1212.6586	966.8116	780.3243	428.0486	180.8600	0.0000	0.0000	0.0000	0.0000	391.0946	807.1982	1231.0237 (211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)	
Water heating requirement													
Water heating requirement	180.9585	141.7294	116.0570	61.8603	33.0641	5.6121	1.1876	31.1511	63.4115	117.0310	155.1478	181.3161 (64)	
Efficiency of water heater (217)m	88.5090	88.5341	88.5137	88.5541	88.1995	79.5000	79.5000	79.5000	79.5000	87.2739	88.1167	79.5000 (216)	
Fuel for water heating, kWh/month	204.4521	160.0845	131.1176	69.8559	37.4879	7.0593	1.4938	39.1837	79.7629	134.0963	176.0707	204.8134 (219)	
Water heating fuel used												1245.4781 (219)	
Annual totals kWh/year													
Space heating fuel - main system												5998.0194 (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)												568.1920 (232)	
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.08 * 1156 * 1.00) =									-998.9833			-998.9833 (233)	
Total delivered energy for all uses												6937.7062 (238)	

10a. Fuel costs - using BEDF prices (443)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5998.0194	3.9200	235.1224 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	1245.4781	3.9200	48.8227 (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	568.1920	16.9600	96.3654 (250)	
Additional standing charges			88.0000 (251)	
Energy saving/generation technologies				
PV Unit	-998.9833	16.9600	-169.4276 (252)	
Total energy cost			320.0829 (255)	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Space heating - main system 1	5998.0194	0.2160	1295.5722 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1245.4781	0.2160	269.0233 (264)
Space and water heating			1564.5955 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	568.1920	0.5190	294.8916 (268)
Energy saving/generation technologies			
PV Unit	-998.9833	0.5190	-518.4723 (269)
Total kg/year			1405.8898 (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	5998.0194	1.2200	7317.5837 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1245.4781	1.2200	1519.4833 (264)
Space and water heating			8837.0670 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	568.1920	3.0700	1744.3494 (268)
Energy saving/generation technologies			
PV Unit	-998.9833	3.0700	-3066.8788 (269)
Primary energy kWh/year			7898.2877 (272)
Primary energy kWh/m2/year			43.0847 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	134.9 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	579.37 (P1)
Transmission heat loss coefficient	123.00 (37)
Summer heat loss coefficient	702.37 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.7000	87.1704	0.6200	0.7000	0.9000	52.0946
North East	8.4500	106.0502	0.6200	0.7000	0.9000	315.0235
East	1.7000	125.2818	0.6200	0.7000	0.9000	74.8706
South East	1.8300	127.3119	0.6200	0.7000	0.9000	81.9020
South West	5.0000	127.3119	0.6200	0.7000	0.9000	223.7760
North West	1.1300	106.0502	0.6200	0.7000	0.9000	42.1274
South West	14.1500	127.3119	0.6200	0.7000	0.9000	633.2862
total:						1423.0805

	Jun	Jul	Aug	
Solar gains	1527	1423	1274	(P3)
Internal gains	668	642	652	
Total summer gains	2196	2065	1927	(P5)
Summer gain/loss ratio	3.13	2.94	2.74	(P6)
Summer external temperature	15.40	17.30	17.30	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Thermal mass temperature increment (TMP = 134.9)	1.06	1.06	1.06	
Threshold temperature	19.58	21.30	21.10	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			