

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-165				Issued on Date	05/12/2019
Assessment Reference	As Built	Prop Type Ref	P404-A - Det (As)			
Property	87, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	88 B	DER	13.00	TER	16.61	
Environmental	88 B	% DER<TER	21.75			
CO ₂ Emissions (t/year)	1.26	DFEE	49.64	TFEE	55.88	
General Requirements Compliance	Pass	% DFEE<TFEE	11.18			
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	T511-0001
Client						

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

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DWELLING AS BUILT

Detached House, total floor area 124 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.61 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.00 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.6 kWh/m²/yrOK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.28 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Promax Ultra Combi 40 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Medium OK

Based on:

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

10 Key features

Door U-value 0.90 W/m²K
Photovoltaic array 0.81 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.2800
Infiltration rate					0.3488 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3488 (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	0.4447	0.4360	0.4272	0.3836	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098 (22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.3514 (36)
Total fabric heat loss (33) + (36) = 104.3852 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.6597	58.2837	57.9151	56.1838	55.8599	54.3520	54.3520	54.0727	54.9328	55.8599	56.5151	57.2002 (38)
Heat transfer coeff	163.0449	162.6689	162.3003	160.5690	160.2451	158.7372	158.7372	158.4580	159.3180	160.2451	160.9004	161.5854 (39)
Average = Sum(39)m / 12 =												160.5675 (39)
HLP	1.3152	1.3122	1.3092	1.2952	1.2926	1.2804	1.2804	1.2782	1.2851	1.2926	1.2979	1.3034 (40)
HLP (average)												1.2952 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602	(61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270	(65)
Total per year (kWh/year) = Sum(64)m =												1859.9338	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	467.1750	464.9175	448.0992	420.6888	392.3539	365.3946	348.0940	354.6592	368.9219	396.5673	428.3807	452.7194	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d				Gains W			
Northeast					4.7600	11.2829	0.7100	0.7000	0.7700				18.4977 (75)			
Southeast					12.2900	36.7938	0.7100	0.7000	0.7700				155.7459 (77)			
Southwest					2.8400	36.7938	0.7100	0.7000	0.7700				35.9901 (79)			
Northwest					6.9600	11.2829	0.7100	0.7000	0.7700				27.0471 (81)			
Northwest					5.8000	11.2829	0.7100	0.7000	0.7700				22.5393 (81)			
Solar gains					259.8201	465.1846	696.5548	963.7500	1171.3807	1203.3338	1431.3196	982.2377	788.1113	530.3242	315.3230	219.6870 (83)
Total gains					726.9952	930.1020	1144.6540	1384.4388	1563.7345	1568.7284	1491.4136	1336.8969	1157.0332	926.8915	743.7037	672.4063 (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	30.8322	30.9035	30.9737	31.3077	31.3710	31.6690	31.6690	31.7248	31.5535	31.3710	31.2432	31.1107	
alpha	3.0555	3.0602	3.0649	3.0872	3.0914	3.1113	3.1113	3.1150	3.1036	3.0914	3.0829	3.0740	
util living area	0.9870	0.9724	0.9404	0.8653	0.7371	0.5767	0.4437	0.5044	0.7366	0.9204	0.9773	0.9897	(86)
MIT	18.8334	19.1461	19.6182	20.1910	20.6331	20.8787	20.9600	20.9404	20.7310	20.1160	19.3615	18.7792	(87)
Th 2	19.8289	19.8313	19.8336	19.8446	19.8466	19.8562	19.8562	19.8580	19.8525	19.8466	19.8425	19.8382	(88)
util rest of house	0.9842	0.9666	0.9277	0.8368	0.6837	0.4941	0.3381	0.3944	0.6623	0.8971	0.9716	0.9874	(89)
MIT 2	16.9545	17.4085	18.0868	18.8920	19.4705	19.7617	19.8360	19.8250	19.6131	18.8116	17.7320	16.8810	(90)
Living area fraction	17.2185	17.6527	18.3020	19.0745	19.6338	19.9186	19.9939	19.9817	19.7702	18.9949	17.9609	17.1478	(92)
MIT	17.2185	17.6527	18.3020	19.0745	19.6338	19.9186	19.9939	19.9817	19.7702	18.9949	17.9609	17.1478	(92)
Temperature adjustment	17.0685	17.5027	18.1520	18.9245	19.4838	19.7686	19.8439	19.8317	19.6202	18.8449	17.8109	16.9978	(93)
adjusted MIT	17.0685	17.5027	18.1520	18.9245	19.4838	19.7686	19.8439	19.8317	19.6202	18.8449	17.8109	16.9978	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9735	0.9493	0.9026	0.8090	0.6647	0.4873	0.3369	0.3917	0.6449	0.8697	0.9560	0.9784	(94)
Ext temp.	707.7195	882.9513	1033.1943	1119.9637	1039.4029	764.4625	502.4450	523.7152	746.1513	806.0907	710.9561	657.9025	(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	2081.8401	2050.0677	1891.1155	1609.6311	1247.3222	820.4510	514.9302	543.7872	879.4614	1321.2025	1723.3947	2067.9318	(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	1022.3457	784.3022	638.2934	352.5605	154.6920	0.0000	0.0000	0.0000	0.0000	383.2432	728.9558	1049.0618	(98)
Space heating per m2												5113.4546	(98)
												(98) / (4) =	41.2475 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5681.6162 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1022.3457	784.3022	638.2934	352.5605	154.6920	0.0000	0.0000	0.0000	0.0000	383.2432	728.9558	1049.0618	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	1135.9397	871.4469	709.2149	391.7339	171.8799	0.0000	0.0000	0.0000	0.0000	425.8257	809.9509	1165.6242	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater (217)m	89.4702	89.4076	89.2788	88.9803	88.3603	86.7000	86.7000	86.7000	86.7000	89.0127	89.3583	89.4939	(216)
Fuel for water heating, kWh/month	210.5188	184.9019	192.6274	170.6957	166.5597	148.9205	140.4217	157.6948	158.5610	177.0625	189.7081	204.5401	(219)
Water heating fuel used												2102.2122	(219)
Annual totals kWh/year													
Space heating fuel - main system												5681.6162	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												457.0496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =												-666.9130	(233)
Total delivered energy for all uses												7648.9651	(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	5681.6162	0.2160	1227.2291	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2102.2122	0.2160	454.0778	(264)
Space and water heating			1681.3069	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	457.0496	0.5190	237.2088	(268)
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278	(269)
Total CO2, kg/year			1611.3129	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.0000	(273)

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

DER			13.0000	ZC1
Total Floor Area		TFA	123.9700	
Assumed number of occupants		N	2.8774	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			13.8762	ZC2
CO2 emissions from cooking, equation (L16)			1.5170	ZC3
Total CO2 emissions			28.3931	ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000	ZC7
Net CO2 emissions			28.3931	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3848 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3848 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4906	0.4810	0.4713	0.4232	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521 (22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5855	0.5668	0.5668	0.5633	0.5740	0.5855	0.5937	0.6022 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			31.0000	1.3258	41.0985		(27)					
Heat Loss Floor 1			62.4900	0.1300	8.1237		(28a)					
100mm Knauf Supafil	158.8600	31.0000	127.8600	0.1800	23.0148		(29a)					
External Roof	60.0500		60.0500	0.1300	7.8065		(30)					
Bay Roof	2.4400		2.4400	0.1300	0.3172		(30)					
Total net area of external elements Aum(A, m2)			283.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.3607		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2327 (36)					
Total fabric heat loss						(33) + (36) =	93.5934 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.7621	60.3044	59.8558	57.7487	57.3544	55.5192	55.5192	55.1793	56.2261	57.3544	58.1520	58.9858 (38)
Heat transfer coeff	154.3555	153.8978	153.4492	151.3420	150.9478	149.1126	149.1126	148.7727	149.8195	150.9478	151.7454	152.5791 (39)
Average = Sum(39)m / 12 =												151.3402 (39)
HLP	Jan 1.2451	Feb 1.2414	Mar 1.2378	Apr 1.2208	May 1.2176	Jun 1.2028	Jul 1.2028	Aug 1.2001	Sep 1.2085	Oct 1.2176	Nov 1.2240	Dec 1.2308 (40)
HLP (average)												1.2208 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)
Energy content (annual)	Total = Sum(45)m =											1613.3389 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.3151	49.1176	45.5105	47.0275	49.1176	49.3151	50.9589	49.3151	50.9589 (61)
Solar input	218.2276	192.3217	201.9215	180.9279	175.4033	154.4854	148.0088	164.9951	166.5765	187.6158	198.4868	212.9497 (62)
	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								Solar input (sum of months) = Sum (63)m =				0.0000 (63)
Heat gains from water heating, kWh/month	218.2276	192.3217	201.9215	180.9279	175.4033	154.4854	148.0088	164.9951	166.5765	187.6158	198.4868	212.9497 (64)
	68.3566	60.1497	62.9348	56.0900	54.2694	47.6118	45.3332	50.8087	51.3182	58.1782	61.9284	66.6017 (65)
								Total per year (kWh/year) = Sum (64)m =				2201.9203 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	91.8771	89.5085	84.5898	77.9028	72.9427	66.1275	60.9317	68.2912	71.2753	78.1964	86.0116	89.5184	(72)
Total internal gains	477.2140	474.9641	458.1618	430.7730	401.8399	374.2041	356.9190	364.1598	379.0275	406.6505	438.4387	462.7660	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					4.5200	11.2829	0.6300	0.7000			0.7700	15.5859 (75)
Southeast					11.6600	36.7938	0.6300	0.7000			0.7700	131.1129 (77)
Southwest					2.7000	36.7938	0.6300	0.7000			0.7700	30.3606 (79)
Northwest					12.1200	11.2829	0.6300	0.7000			0.7700	41.7923 (81)

Solar gains	218.8518	391.8443	586.7619	811.8790	986.8217	1013.7530	963.1888	827.4654	663.8998	446.7208	265.6048	185.0457 (83)
Total gains	696.0658	866.8084	1044.9237	1242.6521	1388.6617	1387.9571	1320.1078	1191.6252	1042.9273	853.3713	704.0434	647.8117 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.7740	55.9399	56.1034	56.8846	57.0331	57.7351	57.7351	57.8670	57.4627	57.0331	56.7334	56.4234	
alpha	4.7183	4.7293	4.7402	4.7923	4.8022	4.8490	4.8490	4.8578	4.8308	4.8022	4.7822	4.7616	
util living area	0.9985	0.9955	0.9851	0.9439	0.8321	0.6482	0.4884	0.5571	0.8248	0.9748	0.9965	0.9989	(86)
MIT	19.5980	19.7967	20.1084	20.5077	20.8142	20.9590	20.9915	20.9846	20.8699	20.4477	19.9478	19.5694	(87)
Th 2	19.8841	19.8870	19.8899	19.9034	19.9059	19.9178	19.9178	19.9199	19.9132	19.9059	19.9008	19.8955	(88)
util rest of house	0.9980	0.9939	0.9797	0.9236	0.7772	0.5544	0.3727	0.4349	0.7464	0.9621	0.9950	0.9986	(89)
MIT 2	18.0181	18.3100	18.7639	19.3364	19.7312	19.8920	19.9148	19.9139	19.8117	19.2661	18.5411	17.9841	(90)
Living area fraction	18.2401	18.5189	18.9528	19.5010	19.8834	20.0420	20.0661	20.0644	19.9604	19.4322	18.7388	18.2069	(92)
Temperature adjustment	18.2401	18.5189	18.9528	19.5010	19.8834	20.0420	20.0661	20.0644	19.9604	19.4322	18.7388	18.2069	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9967	0.9909	0.9732	0.9142	0.7759	0.5658	0.3890	0.4519	0.7504	0.9543	0.9926	0.9976	(94)
Ext temp.	693.7696	858.9480	1016.9659	1136.0219	1077.4916	785.3694	513.4952	538.4691	782.5788	814.3963	698.8106	646.2745	(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	2151.7313	2095.9159	1910.8787	1604.3755	1235.2665	811.4660	516.8422	545.1622	877.9993	1333.1963	1766.1324	2137.1589	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	1084.7235	831.2424	665.0711	337.2146	117.3845	0.0000	0.0000	0.0000	0.0000	385.9872	768.4717	1109.2180	(98)
												5299.3131	(98)
												42.7467	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5673.7827 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1084.7235	831.2424	665.0711	337.2146	117.3845	0.0000	0.0000	0.0000	0.0000	385.9872	768.4717	1109.2180	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	1161.3742	889.9811	712.0676	361.0435	125.6794	0.0000	0.0000	0.0000	0.0000	413.2626	822.7748	1187.5996	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	218.2276	192.3217	201.9215	180.9279	175.4033	154.4854	148.0088	164.9951	166.5765	187.6158	198.4868	212.9497	(64)
Efficiency of water heater (217)m	88.5349	88.3129	87.8272	86.5967	84.0656	80.3000	80.3000	80.3000	80.3000	86.8279	88.1248	88.6050	(216)
Fuel for water heating, kWh/month	246.4877	217.7730	229.9077	208.9317	208.6506	192.3853	184.3198	205.4734	207.4428	216.0778	225.2339	240.3359	(219)
Water heating fuel used												2583.0196	(219)
Annual totals kWh/year													
Space heating fuel - main system												5673.7827	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												457.0496	(232)
Total delivered energy for all uses												8788.8520	(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	5673.7827	0.2160	1225.5371 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2583.0196	0.2160	557.9322 (264)
Space and water heating			1783.4693 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Total CO2, kg/m2/year			2059.6031 (272)
Emissions per m2 for space and water heating			14.3863 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9134 (272b)
Emissions per m2 for pumps and fans			0.3140 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3863 * 1.00) + 1.9134 + 0.3140, rounded to 2 d.p.			16.6100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.2800
Infiltration rate					0.3488 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3488 (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	0.4447	0.4360	0.4272	0.3836	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098 (22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			9.0000	553.3200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17544.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							141.5184 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3514 (36)
Total fabric heat loss							(33) + (36) = 104.3852 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.6597	58.2837	57.9151	56.1838	55.8599	54.3520	54.3520	54.0727	54.9328	55.8599	56.5151	57.2002 (38)
Heat transfer coeff	163.0449	162.6689	162.3003	160.5690	160.2451	158.7372	158.7372	158.4580	159.3180	160.2451	160.9004	161.5854 (39)
Average = Sum(39)m / 12 =												160.5675 (39)
HLP	1.3152	1.3122	1.3092	1.2952	1.2926	1.2804	1.2804	1.2782	1.2851	1.2926	1.2979	1.3034 (40)
HLP (average)												1.2952 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1613.3389 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.5446	31.0875	32.0796	27.9677	26.8357	23.1572	21.4585	24.6240	24.9181	29.0396	31.6990	34.4231 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	47.7750	46.2612	43.1177	38.8441	36.0695	32.1627	28.8421	33.0967	34.6084	39.0317	44.0264	46.2675	(72)
Total internal gains	430.1119	428.7169	413.6897	388.7143	361.9667	337.2394	321.8294	325.9653	339.3607	364.4858	393.4534	416.5151	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast					4.7600	11.2829	0.7100	0.7000			0.7700			18.4977 (75)		
Southeast					12.2900	36.7938	0.7100	0.7000			0.7700			155.7459 (77)		
Southwest					2.8400	36.7938	0.7100	0.7000			0.7700			35.9901 (79)		
Northwest					6.9600	11.2829	0.7100	0.7000			0.7700			27.0471 (81)		
Northwest					5.8000	11.2829	0.7100	0.7000			0.7700			22.5393 (81)		
Solar gains					259.8201	465.1846	696.5548	963.7500	1171.3807	1203.3338	1143.3196	982.2377	788.1113	530.3242	315.3230	219.6870 (83)
Total gains					689.9320	893.9014	1110.2445	1352.4642	1533.3474	1540.5732	1465.1490	1308.2030	1127.4720	894.8100	708.7764	636.2021 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	29.8896	29.9587	30.0267	30.3504	30.4118	30.7007	30.7007	30.7548	30.5888	30.4118	30.2879	30.1595	
alpha	2.9926	2.9972	3.0018	3.0234	3.0275	3.0467	3.0467	3.0503	3.0393	3.0275	3.0192	3.0106	
util living area	0.9877	0.9734	0.9417	0.8675	0.7409	0.5819	0.4492	0.5115	0.7428	0.9233	0.9785	0.9903	(86)
MIT	18.7491	19.0701	19.5557	20.1469	20.6071	20.8671	20.9552	20.9334	20.7090	20.0678	19.2908	18.6942	(87)
Th 2	19.8289	19.8313	19.8336	19.8446	19.8466	19.8562	19.8562	19.8580	19.8525	19.8466	19.8425	19.8382	(88)
util rest of house	0.9851	0.9678	0.9294	0.8397	0.6884	0.4998	0.3431	0.4012	0.6699	0.9010	0.9731	0.9882	(89)
MIT 2	17.7865	18.1057	18.5833	19.1555	19.5694	19.7845	19.8404	19.8323	19.6734	19.0973	18.3354	17.7386	(90)
Living area fraction	17.9218	18.2412	18.7199	19.2948	19.7152	19.9366	19.9970	19.9870	19.8189	19.2336	18.4697	17.8728	(91)
MIT	17.9218	18.2412	18.7199	19.2948	19.7152	19.9366	19.9970	19.9870	19.8189	19.2336	18.4697	17.8728	(92)
Temperature adjustment	17.9218	18.2412	18.7199	19.2948	19.7152	19.9366	19.9970	19.9870	19.8189	19.2336	18.4697	17.8728	(93)
adjusted MIT	17.9218	18.2412	18.7199	19.2948	19.7152	19.9366	19.9970	19.9870	19.8189	19.2336	18.4697	17.8728	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	675.4149	855.9796	1015.2810	1114.5843	1045.2866	779.4517	522.7326	542.2118	752.5726	792.6478	683.4201	625.4546	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2220.9637	2170.2010	1983.2988	1669.0823	1284.3928	847.1168	539.2351	568.3865	911.1238	1383.4998	1829.3811	2209.3330	(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	1149.8883	883.1567	720.2052	399.2386	177.8950	0.0000	0.0000	0.0000	0.0000	439.5939	825.0919	1178.4055	(98)
Space heating												5773.4751	(98)
Space heating per m2												(98) / (4) =	46.5716 (99)

8c. Space cooling requirement

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1492.1297	1174.6553	1204.2805	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8379	0.8882	0.8557	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1250.2189	1043.3814	1030.4989	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1916.9352	1826.1490	1644.8641	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	480.0358	582.3791	457.0877	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1519.5026	(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	120.0089	145.5948	114.2719	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												379.8756	(107)
Space cooling per m2												3.0643	(108)
Energy for space heating												46.5716	(99)
Energy for space cooling												3.0643	(108)
Total												49.6358	(109)
Dwelling Fabric Energy Efficiency (DFEE)												49.6	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3848 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3848 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4906	0.4810	0.4713	0.4232	0.4136	0.3655	0.3655	0.3559	0.3848	0.4136	0.4329	0.4521 (22b)
Effective ac	0.6203	0.6157	0.6111	0.5896	0.5855	0.5668	0.5668	0.5633	0.5740	0.5855	0.5937	0.6022 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opening Type (Uw = 1.40)			31.0000	1.3258	41.0985		(27)					
Heat Loss Floor 1			62.4900	0.1300	8.1237		(28a)					
100mm Knauf Supafil	158.8600	31.0000	127.8600	0.1800	23.0148		(29a)					
External Roof	60.0500		60.0500	0.1300	7.8065		(30)					
Bay Roof	2.4400		2.4400	0.1300	0.3172		(30)					
Total net area of external elements Aum(A, m2)			283.8400				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		80.3607		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2327 (36)					
Total fabric heat loss						(33) + (36) =	93.5934 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.7621	60.3044	59.8558	57.7487	57.3544	55.5192	55.5192	55.1793	56.2261	57.3544	58.1520	58.9858 (38)
Heat transfer coeff	154.3555	153.8978	153.4492	151.3420	150.9478	149.1126	149.1126	148.7727	149.8195	150.9478	151.7454	152.5791 (39)
Average = Sum(39)m / 12 =												151.3402 (39)
HLP	Jan 1.2451	Feb 1.2414	Mar 1.2378	Apr 1.2208	May 1.2176	Jun 1.2028	Jul 1.2028	Aug 1.2001	Sep 1.2085	Oct 1.2176	Nov 1.2240	Dec 1.2308 (40)
HLP (average)												1.2208 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.5446	31.0875	32.0796	27.9677	26.8357	23.1572	21.4585	24.6240	24.9181	29.0396	31.6990	34.4231	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	143.8717	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.8800	22.9864	18.6938	14.1524	10.5791	8.9313	9.6506	12.5442	16.8368	21.3782	24.9516	26.5993	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	290.2954	293.3077	285.7167	269.5562	249.1566	229.9838	217.1752	214.1628	221.7539	237.9143	258.3140	277.4868	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	37.3872	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	47.7750	46.2612	43.1177	38.8441	36.0695	32.1627	28.8421	33.0967	34.6084	39.0317	44.0264	46.2675	(72)
Total internal gains	430.1119	428.7169	413.6897	388.7143	361.9667	337.2394	321.8294	325.9653	339.3607	364.4858	393.4534	416.5151	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
Northeast	4.5200	11.2829	0.6300	0.7000	0.7700	15.5859	(75)
Southeast	11.6600	36.7938	0.6300	0.7000	0.7700	131.1129	(77)
Southwest	2.7000	36.7938	0.6300	0.7000	0.7700	30.3606	(79)
Northwest	12.1200	11.2829	0.6300	0.7000	0.7700	41.7923	(81)

Solar gains	218.8518	391.8443	586.7619	811.8790	986.8217	1013.7530	963.1888	827.4654	663.8998	446.7208	265.6048	185.0457	(83)
Total gains	648.9637	820.5611	1000.4516	1200.5933	1348.7884	1350.9924	1285.0182	1153.4307	1003.2605	811.2066	659.0582	601.5608	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	55.7740	55.9399	56.1034	56.8846	57.0331	57.7351	57.7351	57.8670	57.4627	57.0331	56.7334	56.4234		
alpha	4.7183	4.7293	4.7402	4.7923	4.8022	4.8490	4.8490	4.8578	4.8308	4.8022	4.7822	4.7616		
util living area	0.9989	0.9964	0.9874	0.9501	0.8438	0.6621	0.5008	0.5733	0.8407	0.9793	0.9974	0.9992	(86)	
MIT	19.5632	19.7629	20.0775	20.4836	20.8011	20.9552	20.9906	20.9826	20.8573	20.4197	19.9147	19.5350	(87)	
Th 2	19.8841	19.8870	19.8899	19.9034	19.9059	19.9178	19.9178	19.9199	19.9132	19.9059	19.9008	19.8955	(88)	
util rest of house	0.9985	0.9951	0.9828	0.9315	0.7906	0.5678	0.3827	0.4486	0.7652	0.9684	0.9962	0.9990	(89)	
MIT 2	18.5753	18.7768	19.0910	19.4944	19.7770	19.8983	19.9155	19.9153	19.8358	19.4426	18.9396	18.5562	(90)	
Living area fraction									fLA = Living area / (4) =			0.1405	(91)	
MIT	18.7141	18.9154	19.2296	19.6334	19.9209	20.0468	20.0666	20.0653	19.9793	19.5799	19.0766	18.6937	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7141	18.9154	19.2296	19.6334	19.9209	20.0468	20.0666	20.0653	19.9793	19.5799	19.0766	18.6937	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9936	0.9791	0.9259	0.7914	0.5798	0.3993	0.4661	0.7705	0.9641	0.9950	0.9985	(94)
Ext temp.	647.5893	815.2780	979.5365	1111.5824	1067.4909	783.2484	513.1578	537.6418	773.0455	782.0463	655.7633	600.6706	(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	2224.9004	2156.9333	1953.3476	1624.4101	1240.9277	812.1923	516.9100	545.2892	880.8375	1355.4991	1817.3990	2211.4407	(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	1173.5195	901.5924	724.5154	369.2360	129.0370	0.0000	0.0000	0.0000	0.0000	426.6489	836.3777	1198.4129	(98)
Space heating per m2												5759.3398	(98)
										(98) / (4) =		46.4575	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1401.6580	1103.4329	1130.6724	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8974	0.9441	0.9168	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1257.8662	1041.7335	1036.5639	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1695.3473	1615.6065	1463.9614	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	314.9864	426.9615	317.9837	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												1059.9316 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	78.7466	106.7404	79.4959	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												264.9829 (107)
Space cooling per m2												2.1375 (108)
Energy for space heating												46.4575 (99)
Energy for space cooling												2.1375 (108)
Total												48.5950 (109)
Target Fabric Energy Efficiency (TFEE)												55.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.2800
Infiltration rate					0.3488 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3488 (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	0.3662	0.3400	0.3488	0.3313	0.3313	0.3226	0.3139	0.3052	0.2964	0.3226	0.3052	0.3226 (22b)
Effective ac	0.5671	0.5578	0.5608	0.5549	0.5549	0.5520	0.5493	0.5466	0.5439	0.5520	0.5466	0.5520 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	55.5434	54.6387	54.9328	54.3520	54.3520	54.0727	53.8009	53.5366	53.2797	54.0727	53.5366	54.0727 (38)
Heat transfer coeff	159.9286	159.0239	159.3180	158.7372	158.7372	158.4580	158.1862	157.9218	157.6649	158.4580	157.9218	158.4580 (39)
Average = Sum(39)m / 12 =												158.5678 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2901	1.2828	1.2851	1.2804	1.2804	1.2782	1.2760	1.2739	1.2718	1.2782	1.2739	1.2782 (40)
HLP (average)												1.2791 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1613.3389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (46)
Water storage loss:											
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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 (57)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	21.0602 (61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199 (64)
RHI water heating demand	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866 (65)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866 (65)
											1860 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974 (71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718 (72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				4.7600	14.6176		0.7100		0.7000		0.7700		23.9648 (75)
Southeast				12.2900	45.1778		0.7100		0.7000		0.7700		191.2348 (77)
Southwest				2.8400	45.1778		0.7100		0.7000		0.7700		44.1909 (79)
Northwest				6.9600	14.6176		0.7100		0.7000		0.7700		35.0410 (81)
Northwest				5.8000	14.6176		0.7100		0.7000		0.7700		29.2008 (81)
Solar gains	323.6323	495.0344	752.1569	1054.0066	1221.5787	1364.2103	1285.6546	1129.4275	901.4074	610.3071	391.8814	268.7527	(83)
Total gains	1019.1380	1185.4258	1415.5522	1675.2198	1799.0493	1902.8067	1801.7206	1654.9155	1451.3358	1202.6526	1031.4479	944.5729	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	31.4330	31.6119	31.5535	31.6690	31.6690	31.7248	31.7793	31.8325	31.8843	31.7248	31.8325	31.7248
alpha	3.0955	3.1075	3.1036	3.1113	3.1113	3.1150	3.1186	3.1222	3.1256	3.1150	3.1222	3.1150
util living area	0.9649	0.9456	0.8946	0.7882	0.6395	0.4490	0.3344	0.3613	0.6009	0.8375	0.9395	0.9705 (86)
MIT	19.2692	19.5009	19.9501	20.4494	20.7833	20.9467	20.9842	20.9804	20.8676	20.4393	19.7989	19.2342 (87)
Th 2	19.8486	19.8544	19.8525	19.8562	19.8562	19.8580	19.8597	19.8614	19.8630	19.8580	19.8614	19.8580 (88)
util rest of house	0.9577	0.9348	0.8742	0.7496	0.5776	0.3678	0.2401	0.2605	0.5164	0.7963	0.9252	0.9644 (89)
MIT 2	17.5953	17.9292	18.5603	19.2363	19.6509	19.8223	19.8533	19.8533	19.7596	19.2467	18.3662	17.5516 (90)
Living area fraction	17.8305	18.1500	18.7556	19.4067	19.8101	19.9803	20.0122	20.0117	19.9153	19.4143	18.5675	17.7880 (92)
Temperature adjustment	17.6805	18.0000	18.6056	19.2567	19.6601	19.8303	19.8622	19.8617	19.7653	19.2643	18.4175	17.6380 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	956.2333	1080.1193	1198.0272	1216.7039	1018.4076	696.0029	432.9407	431.1181	737.9421	926.3580	928.7071	894.2556 (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	2043.9700	2019.6095	1848.9824	1548.7570	1136.5670	717.8569	436.9429	436.1338	798.6195	1246.1561	1660.9460	2002.5926 (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	809.2761	631.3374	484.3106	239.0782	87.9106	0.0000	0.0000	0.0000	0.0000	237.9298	527.2120	824.6028 (98)
Space heating												3841.6575 (98)
RHI space heating demand												3842 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.2800
Infiltration rate					0.3488 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3488 (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	0.4447	0.4360	0.4272	0.3836	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098 (22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.6597	58.2837	57.9151	56.1838	55.8599	54.3520	54.3520	54.0727	54.9328	55.8599	56.5151	57.2002 (38)
Heat transfer coeff	163.0449	162.6689	162.3003	160.5690	160.2451	158.7372	158.7372	158.4580	159.3180	160.2451	160.9004	161.5854 (39)
Average = Sum(39)m / 12 =												160.5675 (39)
HLP	1.3152	1.3122	1.3092	1.2952	1.2926	1.2804	1.2804	1.2782	1.2851	1.2926	1.2979	1.3034 (40)
HLP (average)												1.2952 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1613.3389 (45)											
Distribution loss (46)m = 0.15 x (45)m	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602 (61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m = 0.0000 (63)				
Output from w/h	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (64)
	Total per year (kWh/year) = Sum(64)m = 1859.9338 (64)											
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
Northeast					4.7600	11.2829	0.7100	0.7000			0.7700			18.4977 (75)
Southeast					12.2900	36.7938	0.7100	0.7000			0.7700			155.7459 (77)
Southwest					2.8400	36.7938	0.7100	0.7000			0.7700			35.9901 (79)
Northwest					6.9600	11.2829	0.7100	0.7000			0.7700			27.0471 (81)
Northwest					5.8000	11.2829	0.7100	0.7000			0.7700			22.5393 (81)
Solar gains	259.8201	465.1846	696.5548	963.7500	1171.3807	1203.3338	1143.3196	982.2377	788.1113	530.3242	315.3230			219.6870 (83)
Total gains	955.3257	1155.5759	1359.9501	1584.9632	1748.8513	1741.9302	1659.3856	1507.7256	1338.0397	1122.6697	954.8895			895.5071 (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	30.8322	30.9035	30.9737	31.3077	31.3710	31.6690	31.6690	31.7248	31.5535	31.3710	31.2432	31.1107	
alpha	3.0555	3.0602	3.0649	3.0872	3.0914	3.1113	3.1113	3.1150	3.1036	3.0914	3.0829	3.0740	
util living area	0.9732	0.9526	0.9119	0.8261	0.6922	0.5322	0.4039	0.4561	0.6777	0.8799	0.9571	0.9776	(86)
MIT	19.0626	19.3584	19.7954	20.3119	20.6960	20.9032	20.9693	20.9551	20.7903	20.2624	19.5646	19.0068	(87)
Th 2	19.8289	19.8313	19.8336	19.8446	19.8466	19.8562	19.8562	19.8580	19.8525	19.8466	19.8425	19.8382	(88)
util rest of house	0.9677	0.9432	0.8946	0.7928	0.6366	0.4524	0.3057	0.3534	0.6004	0.8486	0.9470	0.9730	(89)
MIT 2	17.2852	17.7109	18.3319	19.0480	19.5408	19.7823	19.8410	19.8338	19.6720	19.0045	18.0208	17.2102	(90)
Living area fraction	17.5350	17.9424	18.5376	19.2256	19.7031	19.9398	19.9995	19.9913	19.8292	19.1813	18.2377	17.4627	(92)
MIT	17.3850	17.7924	18.3876	19.0756	19.5531	19.7898	19.8495	19.8413	19.6792	19.0313	18.0877	17.3127	(93)
Temperature adjustment													-0.1500
adjusted MIT													

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9507	0.9205	0.8668	0.7667	0.6210	0.4475	0.3052	0.3518	0.5873	0.8205	0.9251	0.9578	(94)
Useful gains	908.2125	1063.6641	1178.8401	1215.1747	1085.9745	779.5200	506.3658	530.4286	785.7710	921.1350	883.3550	857.7549	(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	2133.4363	2097.1944	1929.3564	1633.8866	1258.4279	823.8174	515.8189	545.3054	888.8592	1351.0664	1767.9298	2118.8168	(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	911.5665	694.5324	558.3841	301.4726	128.3053	0.0000	0.0000	0.0000	0.0000	319.8690	636.8939	938.2301	(98)
Space heating												4489.2539	(98)
Space heating per m2												36.2124	(99)
										(98) / (4) =			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4988.0599 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	911.5665	694.5324	558.3841	301.4726	128.3053	0.0000	0.0000	0.0000	0.0000	319.8690	636.8939	938.2301	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	1012.8517	771.7026	620.4268	334.9696	142.5615	0.0000	0.0000	0.0000	0.0000	355.4100	707.6599	1042.4779	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater (217)m	89.4172	89.3462	89.2005	88.8668	88.2064	86.7000	86.7000	86.7000	86.7000	88.8833	89.2856	89.4442	(216)
Fuel for water heating, kWh/month	210.6436	185.0290	192.7963	170.9137	166.8504	148.9205	140.4217	157.6948	158.5610	177.3203	189.8625	204.6538	(219)
Water heating fuel used												2103.6675	(219)
Annual totals kWh/year													
Space heating fuel - main system												4988.0599	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												457.0496	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												6956.8640	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4988.0599	3.4800	173.5845 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2103.6675	3.4800	73.2076 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	457.0496	13.1900	60.2848 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-666.9130	13.1900	-87.9658 (252)
Total energy cost			349.0036 (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] =	0.8675 (257)
SAP value		87.8984
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4988.0599	0.2160	1077.4209 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2103.6675	0.2160	454.3922 (264)
Space and water heating			1531.8131 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-666.9130	0.5190	-346.1278 (269)
Total kg/year			1461.8190 (272)
CO2 emissions per m2			11.7900 (273)
EI value			88.4072
EI rating			88 (274)
EI band			B

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8829 = 3.942$, stars = 4
Water heating environmental impact	$0.216 / 0.8829 = 0.2447$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.2800
Infiltration rate					0.3488 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3488 (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	0.3662	0.3400	0.3488	0.3313	0.3313	0.3226	0.3139	0.3052	0.2964	0.3226	0.3052	0.3226 (22b)
Effective ac	0.5671	0.5578	0.5608	0.5549	0.5549	0.5520	0.5493	0.5466	0.5439	0.5520	0.5466	0.5520 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 11.3514 (36)
Total fabric heat loss (33) + (36) = 104.3852 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	55.5434	54.6387	54.9328	54.3520	54.3520	54.0727	53.8009	53.5366	53.2797	54.0727	53.5366	54.0727 (38)
Heat transfer coeff	159.9286	159.0239	159.3180	158.7372	158.7372	158.4580	158.1862	157.9218	157.6649	158.4580	157.9218	158.4580 (39)
Average = Sum(39)m / 12 =												158.5678 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2901	1.2828	1.2851	1.2804	1.2804	1.2782	1.2760	1.2739	1.2718	1.2782	1.2739	1.2782 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8774 (42)
Average daily hot water use (litres/day)												102.5391 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Energy content (annual)												Total = Sum(45)m =	1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602	(61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
												Total per year (kWh/year) = Sum(64)m =	1859.9338 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				4.7600	14.6176	0.7100	0.7000	0.7700	23.9648 (75)			
Southeast				12.2900	45.1778	0.7100	0.7000	0.7700	191.2348 (77)			
Southwest				2.8400	45.1778	0.7100	0.7000	0.7700	44.1909 (79)			
Northwest				6.9600	14.6176	0.7100	0.7000	0.7700	35.0410 (81)			
Northwest				5.8000	14.6176	0.7100	0.7000	0.7700	29.2008 (81)			
Solar gains	323.6323	495.0344	752.1569	1054.0066	1221.5787	1364.2103	1285.6546	1129.4275	901.4074	610.3071	391.8814	268.7527 (83)
Total gains	1019.1380	1185.4258	1415.5522	1675.2198	1799.0493	1902.8067	1801.7206	1654.9155	1451.3358	1202.6526	1031.4479	944.5729 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.4330	31.6119	31.5535	31.6690	31.6690	31.7248	31.7793	31.8325	31.8843	31.7248	31.8325	31.7248	
alpha	3.0955	3.1075	3.1036	3.1113	3.1113	3.1150	3.1186	3.1222	3.1256	3.1150	3.1222	3.1150	
util living area	0.9649	0.9456	0.8946	0.7882	0.6395	0.4490	0.3344	0.3613	0.6009	0.8375	0.9395	0.9705	(86)
MIT	19.2692	19.5009	19.9501	20.4494	20.7833	20.9467	20.9842	20.9804	20.8676	20.4393	19.7989	19.2342	(87)
Th 2	19.8486	19.8544	19.8525	19.8562	19.8562	19.8580	19.8597	19.8614	19.8630	19.8580	19.8614	19.8580	(88)
util rest of house	0.9577	0.9348	0.8742	0.7496	0.5776	0.3678	0.2401	0.2605	0.5164	0.7963	0.9252	0.9644	(89)
MIT 2	17.5953	17.9292	18.5603	19.2363	19.6509	19.8223	19.8533	19.8533	19.7596	19.2467	18.3662	17.5516	(90)
Living area fraction	17.8305	18.1500	18.7556	19.4067	19.8101	19.9803	20.0122	20.0117	19.9153	19.4143	18.5675	17.7880	(92)
MIT	17.8305	18.1500	18.7556	19.4067	19.8101	19.9803	20.0122	20.0117	19.9153	19.4143	18.5675	17.7880	(92)
Temperature adjustment	17.6805	18.0000	18.6056	19.2567	19.6601	19.8303	19.8622	19.8617	19.7653	19.2643	18.4175	17.6380	(93)
adjusted MIT	17.6805	18.0000	18.6056	19.2567	19.6601	19.8303	19.8622	19.8617	19.7653	19.2643	18.4175	17.6380	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	956.2333	1080.1193	1198.0272	1216.7039	1018.4076	696.0029	432.9407	431.1181	737.9421	926.3580	928.7071	894.2556	(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	2043.9700	2019.6095	1848.9824	1548.7570	1136.5670	717.8569	436.9429	436.1338	798.6195	1246.1561	1660.9460	2002.5926	(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	809.2761	631.3374	484.3106	239.0782	87.9106	0.0000	0.0000	0.0000	0.0000	237.9298	527.2120	824.6028	(98)
Space heating												3841.6575	(98)
Space heating per m2												30.9886	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4268.5083 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	809.2761	631.3374	484.3106	239.0782	87.9106	0.0000	0.0000	0.0000	0.0000	237.9298	527.2120	824.6028	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	899.1956	701.4860	538.1229	265.6424	97.6784	0.0000	0.0000	0.0000	0.0000	264.3664	585.7912	916.2253	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater (217)m	89.3579	89.2947	89.1112	88.6886	87.9053	86.7000	86.7000	86.7000	86.7000	88.6554	89.1742	89.3820	(216)
Fuel for water heating, kWh/month	210.7834	185.1356	192.9896	171.2571	167.4218	148.9205	140.4217	157.6948	158.5610	177.7761	190.0997	204.7963	(219)
Water heating fuel used												2105.8576	(219)
Annual totals kWh/year													
Space heating fuel - main system												4268.5083	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													457.0496 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												6157.1781	(238)

10a. Fuel costs - using BEDF prices (453)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4268.5083	3.9300	167.7524 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2105.8576	3.9300	82.7602 (247)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	457.0496	17.5600	80.2579 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-749.2375	17.5600	-131.5661 (252)
Total energy cost			300.3744 (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	4268.5083	0.2160	921.9978 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2105.8576	0.2160	454.8652 (264)
Space and water heating			1376.8630 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	457.0496	0.5190	237.2088 (268)
Energy saving/generation technologies			
PV Unit	-749.2375	0.5190	-388.8543 (269)
Total kg/year			1264.1425 (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	4268.5083	1.2200	5207.5801 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2105.8576	1.2200	2569.1463 (264)
Space and water heating			7776.7264 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	457.0496	3.0700	1403.1424 (268)
Energy saving/generation technologies			
PV Unit	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			7109.9597 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

57.3523 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 32	-200 kg (15.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 1.62 kg/m ²	B 89	B 90
Total Savings	£32 1.62 kg/m ²		

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

Fuel prices for cost data on this page from database revision number 453 TEST (27 Nov 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	£93	£102	-£9
Mains gas	£339	£297	£41
Space heating	£269	£269	£0
Water heating	£83	£50	£32
Lighting	£80	£80	£0
Generated (PV)	-£132	-£132	£0
Total cost of fuels	£300	£267	£32
Total cost of uses	£300	£267	£32
Delivered energy	50 kWh/m ²	42 kWh/m ²	8 kWh/m ²
Carbon dioxide emissions	1.3 tonnes	1.1 tonnes	0.2 tonnes
CO2 emissions per m ²	10 kg/m ²	9 kg/m ²	2 kg/m ²
Primary energy	57 kWh/m ²	48 kWh/m ²	9 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.2800
Infiltration rate					0.3488 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3488 (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	0.4447	0.4360	0.4272	0.3836	0.3749	0.3313	0.3313	0.3226	0.3488	0.3749	0.3924	0.4098 (22b)
Effective ac	0.5989	0.5950	0.5913	0.5736	0.5703	0.5549	0.5549	0.5520	0.5608	0.5703	0.5770	0.5840 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
145.9817 (35)
11.3514 (36)
(33) + (36) = 104.3852 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	58.6597	58.2837	57.9151	56.1838	55.8599	54.3520	54.3520	54.0727	54.9328	55.8599	56.5151	57.2002 (38)
Heat transfer coeff	163.0449	162.6689	162.3003	160.5690	160.2451	158.7372	158.7372	158.4580	159.3180	160.2451	160.9004	161.5854 (39)
Average = Sum(39)m / 12 =												160.5675 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3152	1.3122	1.3092	1.2952	1.2926	1.2804	1.2804	1.2782	1.2851	1.2926	1.2979	1.3034 (40)
HLP (average)												1.2952 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1613.3389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	21.0602 (61)
Total heat required for water heating calculated for each month											
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-25.5407	-42.6201	-72.5868	-97.2807	-120.1821	-118.1581	-116.5966	-101.8710	-79.7855	-54.4841	-30.2949
Solar input (sum of months) = Sum (63)m =											
-880.7738											
Output from w/h											
162.8109	122.6962	99.3885	54.6048	26.9906	10.9560	5.1490	34.8503	57.6869	103.1241	139.2249	161.6778 (64)
Heat gains from water heating, kWh/month											
60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W				
Northeast					4.7600	11.2829		0.7100	0.7000	0.7700		18.4977 (75)				
Southeast					12.2900	36.7938		0.7100	0.7000	0.7700		155.7459 (77)				
Southwest					2.8400	36.7938		0.7100	0.7000	0.7700		35.9901 (79)				
Northwest					6.9600	11.2829		0.7100	0.7000	0.7700		27.0471 (81)				
Northwest					5.8000	11.2829		0.7100	0.7000	0.7700		22.5393 (81)				
Solar gains					259.8201	465.1846	696.5548	963.7500	1171.3807	1203.3338	1143.3196	982.2377	788.1113	530.3242	315.3230	219.6870 (83)
Total gains					955.3257	1155.5759	1359.9501	1584.9632	1748.8513	1741.9302	1659.3856	1507.7256	1338.0397	1122.6697	954.8895	895.5071 (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	30.8322	30.9035	30.9737	31.3077	31.3710	31.6690	31.6690	31.7248	31.5535	31.3710	31.2432	31.1107
alpha	3.0555	3.0602	3.0649	3.0872	3.0914	3.1113	3.1113	3.1150	3.1036	3.0914	3.0829	3.0740
util living area	0.9732	0.9526	0.9119	0.8261	0.6922	0.5322	0.4039	0.4561	0.6777	0.8799	0.9571	0.9776 (86)
MIT	19.0626	19.3584	19.7954	20.3119	20.6960	20.9032	20.9693	20.9551	20.7903	20.2624	19.5646	19.0068 (87)
Th 2	19.8289	19.8313	19.8336	19.8446	19.8466	19.8562	19.8562	19.8580	19.8525	19.8466	19.8425	19.8382 (88)
util rest of house	0.9677	0.9432	0.8946	0.7928	0.6366	0.4524	0.3057	0.3534	0.6004	0.8486	0.9470	0.9730 (89)
MIT 2	17.2852	17.7109	18.3319	19.0480	19.5408	19.7823	19.8410	19.8338	19.6720	19.0045	18.0208	17.2102 (90)
Living area fraction										fLA = Living area / (4) =		0.1405 (91)
MIT	17.5350	17.9424	18.5376	19.2256	19.7031	19.9398	19.9995	19.9913	19.8292	19.1813	18.2377	17.4627 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3850	17.7924	18.3876	19.0756	19.5531	19.7898	19.8495	19.8413	19.6792	19.0313	18.0877	17.3127 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9507	0.9205	0.8668	0.7667	0.6210	0.4475	0.3052	0.3518	0.5873	0.8205	0.9251	0.9578	(94)
Useful gains	908.2125	1063.6641	1178.8401	1215.1747	1085.9745	779.5200	506.3658	530.4286	785.7710	921.1350	883.3550	857.7549	(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	2133.4363	2097.1944	1929.3564	1633.8866	1258.4279	823.8174	515.8189	545.3054	888.8592	1351.0664	1767.9298	2118.8168	(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	911.5665	694.5324	558.3841	301.4726	128.3053	0.0000	0.0000	0.0000	0.0000	319.8690	636.8939	938.2301	(98)
Space heating												4489.2539	(98)
Space heating per m2												(98) / (4) =	36.2124 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4988.0599 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	911.5665	694.5324	558.3841	301.4726	128.3053	0.0000	0.0000	0.0000	0.0000	319.8690	636.8939	938.2301	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	1012.8517	771.7026	620.4268	334.9696	142.5615	0.0000	0.0000	0.0000	0.0000	355.4100	707.6599	1042.4779	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	162.8109	122.6962	99.3885	54.6048	26.9906	10.9560	5.1490	34.8503	57.6869	103.1241	139.2249	161.6778	(64)
Efficiency of water heater	89.4839	89.4886	89.4854	89.4777	89.4085	86.7000	86.7000	86.7000	86.7000	89.1725	89.3897	89.4993	(216)
Fuel for water heating, kWh/month	181.9444	137.1082	111.0668	61.0262	30.1879	12.6366	5.9389	40.1965	66.5362	115.6456	155.7506	180.6471	(219)
Water heating fuel used												1098.6849	(219)
Annual totals kWh/year													
Space heating fuel - main system												4988.0599	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													457.0496 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												6001.8814	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4988.0599	3.4800	173.5845	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1098.6849	3.4800	38.2342	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	457.0496	13.1900	60.2848	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-666.9130	13.1900	-87.9658	(252)
Total energy cost			320.6252	(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] =	0.7970 (257)
SAP value		88.8824
SAP rating (Section 12)		89 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4988.0599	0.2160	1077.4209	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1098.6849	0.2160	237.3159	(264)
Space and water heating			1314.7369	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	457.0496	0.5190	237.2088	(268)
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278	(269)
Total kg/year			1270.6928	(272)
CO2 emissions per m2			10.2500	(273)
EI value			89.9229	
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	62.4900 (1b)	x 2.3100 (2b)	= 144.3519 (1b) - (3b)
First floor	61.4800 (1c)	x 2.4800 (2c)	= 152.4704 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	123.9700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 296.8223 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.2800
Infiltration rate					0.3488 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3488 (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	0.3662	0.3400	0.3488	0.3313	0.3313	0.3226	0.3139	0.3052	0.2964	0.3226	0.3052	0.3226 (22b)
Effective ac	0.5671	0.5578	0.5608	0.5549	0.5549	0.5520	0.5493	0.5466	0.5439	0.5520	0.5466	0.5520 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.40)			26.8500	1.3258	35.5966		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			62.4900	0.1600	9.9984	75.0000	4686.7500 (28a)
100mm Knauf Supafil	158.8600	32.6500	126.2100	0.2500	31.5525	60.0000	7572.6000 (29a)
External Roof	60.0500		60.0500	0.1300	7.8065	9.0000	540.4500 (30)
Bay Roof	2.4400		2.4400	0.1600	0.3904	9.0000	21.9600 (30)
Total net area of external elements Aum(A, m ²)			283.8400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.0338		(33)
GF			35.5700			39.0000	1387.2300 (32c)
GF			60.5700			9.0000	545.1300 (32c)
FF			125.5500			9.0000	1129.9500 (32c)
Internal Floor 1			61.4800			18.0000	1106.6400 (32d)
Internal Floor 1			61.4800			18.0000	1106.6400 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP) = Cm / TFA in kJ/m²K
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Total fabric heat loss
 (28)...(30) + (32) + (32a)...(32e) = 18097.3500 (34)
 145.9817 (35)
 11.3514 (36)
 (33) + (36) = 104.3852 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	55.5434	54.6387	54.9328	54.3520	54.3520	54.0727	53.8009	53.5366	53.2797	54.0727	53.5366	54.0727 (38)
Heat transfer coeff	159.9286	159.0239	159.3180	158.7372	158.7372	158.4580	158.1862	157.9218	157.6649	158.4580	157.9218	158.4580 (39)
Average = Sum(39)m / 12 =												158.5678 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2901	1.2828	1.2851	1.2804	1.2804	1.2782	1.2760	1.2739	1.2718	1.2782	1.2739	1.2782 (40)
HLP (average)												1.2791 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum (45)m = 1613.3389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	21.0602 (61)
Total heat required for water heating calculated for each month											
188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1208.1510 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											2029.6937 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.2581 (H8)
Collector performance factor											0.5484 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											102.5391 (H14)
Solar storage volume factor											0.7314 (H15)
Solar input											0.9374 (H16)
Solar input	-29.9291	-42.5572	-73.1457	-98.6904	-115.9178	-123.8186	-121.2146	-108.4908	-84.9408	-58.7251	-35.3982
Solar input (sum of months) = Sum (63)m =											-917.4387 (H17)
Output from w/h	158.4225	122.7591	98.8297	53.1951	31.2548	5.2955	0.5310	28.2306	52.5316	98.8830	134.1217
Total per year (kWh/year) = Sum (64)m =											942.4951 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866
											59.1270 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	172.6461	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.7001	57.4661	46.7345	35.3811	26.4478	22.3283	24.1265	31.3606	42.0921	53.4456	62.3789	66.4983	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	433.2767	437.7727	426.4428	402.3227	371.8755	343.2594	324.1421	319.6460	330.9760	355.0960	385.5432	414.1593	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	55.1420	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)	81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					4.7600	14.6176		0.7100	0.7000	0.7700		23.9648 (75)	
Southeast					12.2900	45.1778		0.7100	0.7000	0.7700		191.2348 (77)	
Southwest					2.8400	45.1778		0.7100	0.7000	0.7700		44.1909 (79)	
Northwest					6.9600	14.6176		0.7100	0.7000	0.7700		35.0410 (81)	
Northwest					5.8000	14.6176		0.7100	0.7000	0.7700		29.2008 (81)	
Solar gains	323.6323	495.0344	752.1569	1054.0066	1221.5787	1364.2103	1285.6546	1129.4275	901.4074	610.3071	391.8814	268.7527 (83)	
Total gains	1019.1380	1185.4258	1415.5522	1675.2198	1799.0493	1902.8067	1801.7206	1654.9155	1451.3358	1202.6526	1031.4479	944.5729 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	31.4330	31.6119	31.5535	31.6690	31.6690	31.7248	31.7793	31.8325	31.8843	31.7248	31.8325	31.7248
util living area	3.0955	3.1075	3.1036	3.1113	3.1113	3.1150	3.1186	3.1222	3.1256	3.1150	3.1222	3.1150
	0.9649	0.9456	0.8946	0.7882	0.6395	0.4490	0.3344	0.3613	0.6009	0.8375	0.9395	0.9705 (86)
MIT	19.2692	19.5009	19.9501	20.4494	20.7833	20.9467	20.9842	20.9804	20.8676	20.4393	19.7989	19.2342 (87)
Th 2	19.8486	19.8544	19.8525	19.8562	19.8562	19.8580	19.8597	19.8614	19.8630	19.8580	19.8614	19.8580 (88)
util rest of house	0.9577	0.9348	0.8742	0.7496	0.5776	0.3678	0.2401	0.2605	0.5164	0.7963	0.9252	0.9644 (89)
MIT 2	17.5953	17.9292	18.5603	19.2363	19.6509	19.8223	19.8533	19.8533	19.7596	19.2467	18.3662	17.5516 (90)
Living area fraction	17.8305	18.1500	18.7556	19.4067	19.8101	19.9803	20.0122	20.0117	19.9153	19.4143	18.5675	17.7880 (92)
Temperature adjustment	17.6805	18.0000	18.6056	19.2567	19.6601	19.8303	19.8622	19.8617	19.7653	19.2643	18.4175	17.6380 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9383	0.9112	0.8463	0.7263	0.5661	0.3658	0.2403	0.2605	0.5085	0.7703	0.9004	0.9467	(94)
Useful gains	956.2333	1080.1193	1198.0272	1216.7039	1018.4076	696.0029	432.9407	431.1181	737.9421	926.3580	928.7071	894.2556	(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	2043.9700	2019.6095	1848.9824	1548.7570	1136.5670	717.8569	436.9429	436.1338	798.6195	1246.1561	1660.9460	2002.5926	(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	809.2761	631.3374	484.3106	239.0782	87.9106	0.0000	0.0000	0.0000	0.0000	237.9298	527.2120	824.6028	(98)
Space heating												3841.6575	(98)
Space heating per m2												(98) / (4) =	30.9886 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4268.5083 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	809.2761	631.3374	484.3106	239.0782	87.9106	0.0000	0.0000	0.0000	0.0000	237.9298	527.2120	824.6028	(98)
Space heating efficiency (main heating system 1)	90.0000	90.0000	90.0000	90.0000	90.0000	0.0000	0.0000	0.0000	0.0000	90.0000	90.0000	90.0000	(210)
Space heating fuel (main heating system)	899.1956	701.4860	538.1229	265.6424	97.6784	0.0000	0.0000	0.0000	0.0000	264.3664	585.7912	916.2253	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	158.4225	122.7591	98.8297	53.1951	31.2548	5.2955	0.5310	28.2306	52.5316	98.8830	134.1217	158.4406	(64)
Efficiency of water heater	89.4427	89.4458	89.4232	89.3808	89.1104	86.7000	86.7000	86.7000	86.7000	89.0054	89.3106	89.4512	(216)
Fuel for water heating, kWh/month	177.1219	137.2441	110.5191	59.5151	35.0743	6.1079	0.6124	32.5613	60.5901	111.0977	150.1744	177.1251	(219)
Water heating fuel used												1057.7433	(219)
Annual totals kWh/year													
Space heating fuel - main system												4268.5083	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													457.0496 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												5159.0637	(238)

10a. Fuel costs - using BEDF prices (453)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4268.5083	3.9300	167.7524	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1057.7433	3.9300	41.5693	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Pump for solar water heating	50.0000	17.5600	8.7800	(249)
Energy for lighting	457.0496	17.5600	80.2579	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	17.5600	-131.5661	(252)
Total energy cost			267.9635	(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	4268.5083	0.2160	921.9978	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1057.7433	0.2160	228.4725	(264)
Space and water heating			1150.4703	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	457.0496	0.5190	237.2088	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-749.2375	0.5190	-388.8543 (269)
Total kg/year			1063.6999 (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	4268.5083	1.2200	5207.5801 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1057.7433	1.2200	1290.4468 (264)
Space and water heating			6498.0269 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	457.0496	3.0700	1403.1424 (268)

Energy saving/generation technologies			
PV Unit	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			5984.7603 (272)
Primary energy kWh/m2/year			48.2759 (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	South East
Overshading	Average or unknown
Thermal mass parameter	146.0 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

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

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North 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	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North 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	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	4.7600	106.0502	0.7100	0.7000	0.9000	203.2169
South East	12.2900	127.3119	0.7100	0.7000	0.9000	629.8863
South West	2.8400	127.3119	0.7100	0.7000	0.9000	145.5555
North West	6.9600	106.0502	0.7100	0.7000	0.9000	297.1407
North West	5.8000	106.0502	0.7100	0.7000	0.9000	247.6173

total: 1523.4167

	Jun	Jul	Aug	
Solar gains	1643	1523	1334	(P3)
Internal gains	536	513	522	
Total summer gains	2179	2036	1856	(P5)
Summer gain/loss ratio	4.39	4.10	3.74	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 146.0)	0.98	0.98	0.98	
Threshold temperature	20.77	22.38	22.02	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			