

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-148				Issued on Date	01/07/2019
Assessment Reference	As Built	Prop Type Ref	404-A - Det (As)			
Property	53, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	88 B	DER	12.92	TER	16.50	
Environmental	88 B	% DER<TER	21.69			
CO ₂ Emissions (t/year)	1.25	DFEE	50.13	TFEE	55.48	
General Requirements Compliance	Pass	% DFEE<TFEE	9.65			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessouthern.co.uk				Assessor ID	P637-0001
Client						

FULL SAP CALCULATION PRINTOUT

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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) 16.50 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.18 (max. 0.25)	0.18 (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: 4.55 (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: 2.84 m², No overhang
Windows facing East: 12.76 m², No overhang
Windows facing South: 4.76 m², No overhang
Windows facing West: 12.29 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3623 (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) =	0.3623 (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	0.4619	0.4528	0.4438	0.3985	0.3894	0.3441	0.3441	0.3351	0.3623	0.3894	0.4075	0.4257 (22b)
Effective ac	0.6067	0.6025	0.5985	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (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	0.1800	11.2482	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) =		94.2836		(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/m ² K							145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3514 (36)
Total fabric heat loss							(33) + (36) = 105.6350 (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	59.4239	59.0182	58.6205	56.7526	56.4031	54.7762	54.7762	54.4750	55.4029	56.4031	57.1101	57.8493 (38)
Heat transfer coeff	165.0590	164.6532	164.2555	162.3876	162.0382	160.4113	160.4113	160.1100	161.0379	162.0382	162.7452	163.4843 (39)
Average = Sum(39)m / 12 =												162.3860 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3314	1.3282	1.3250	1.3099	1.3071	1.2940	1.2940	1.2915	1.2990	1.3071	1.3128	1.3187 (40)
HLP (average)												1.3099 (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)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				2.8400	10.6334	0.7100	0.7000		0.7700		10.4011 (74)	
East				6.9600	19.6403	0.7100	0.7000		0.7700		47.0811 (76)	
South				4.7600	46.7521	0.7100	0.7000		0.7700		76.6474 (78)	
West				12.2900	19.6403	0.7100	0.7000		0.7700		83.1359 (80)	
East				5.8000	19.6403	0.7100	0.7000		0.7700		39.2342 (76)	
Solar gains	256.4997	476.8882	739.5817	1031.1452	1237.1435	1258.3136	1201.0598	1046.7600	842.5549	552.3874	314.9701	214.2497 (83)
Total gains	723.6748	941.8057	1187.6810	1451.8340	1629.4973	1623.7083	1549.1538	1401.4192	1211.4768	948.9547	743.3508	666.9691 (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	30.4560	30.5311	30.6050	30.9570	31.0238	31.3385	31.3385	31.3974	31.2165	31.0238	30.8890	30.7494
alpha	3.0304	3.0354	3.0403	3.0638	3.0683	3.0892	3.0892	3.0932	3.0811	3.0683	3.0593	3.0500
util living area	0.9871	0.9717	0.9357	0.8540	0.7240	0.5656	0.4328	0.4888	0.7214	0.9170	0.9775	0.9899 (86)
MIT	18.8029	19.1309	19.6309	20.2156	20.6457	20.8824	20.9617	20.9440	20.7427	20.1175	19.3399	18.7479 (87)
Th 2	19.8163	19.8188	19.8213	19.8331	19.8353	19.8456	19.8456	19.8475	19.8416	19.8353	19.8308	19.8262 (88)
util rest of house	0.9843	0.9657	0.9221	0.8238	0.6694	0.4831	0.3283	0.3802	0.6456	0.8927	0.9717	0.9876 (89)
MIT 2	16.9030	17.3791	18.0961	18.9151	19.4747	19.7547	19.8264	19.8170	19.6151	18.8056	17.6938	16.8287 (90)
Living area fraction	17.1699	17.6252	18.3118	19.0978	19.6392	19.9132	19.9859	19.9753	19.7735	18.9900	17.9251	17.0984 (92)
MIT	17.1699	17.6252	18.3118	19.0978	19.6392	19.9132	19.9859	19.9753	19.7735	18.9900	17.9251	17.0984 (92)
Temperature adjustment	17.0199	17.4752	18.1618	18.9478	19.4892	19.7632	19.8359	19.8253	19.6235	18.8400	17.7751	16.9484 (93)
adjusted MIT	17.0199	17.4752	18.1618	18.9478	19.4892	19.7632	19.8359	19.8253	19.6235	18.8400	17.7751	16.9484 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9737	0.9479	0.8961	0.7960	0.6512	0.4767	0.3274	0.3780	0.6291	0.8649	0.9560	0.9787 (94)
Useful gains	704.6129	892.7772	1064.2741	1155.7016	1061.0980	774.0685	507.1662	529.6967	762.1476	820.7038	710.6288	652.7874 (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	2099.5396	2070.5535	1915.5087	1631.6401	1262.1528	828.2349	519.0800	548.4309	889.4997	1335.1919	1737.3263	2084.1659 (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	1037.8255	791.4657	633.3185	342.6757	149.5848	0.0000	0.0000	0.0000	0.0000	382.7791	739.2222	1064.9456 (98)
Space heating												5141.8171 (98)
Space heating per m2												41.4763 (99)
										(98) / (4) =		

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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													5713.1301 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1037.8255	791.4657	633.3185	342.6757	149.5848	0.0000	0.0000	0.0000	0.0000	382.7791	739.2222	1064.9456	(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)	1153.1394	879.4063	703.6872	380.7508	166.2053	0.0000	0.0000	0.0000	0.0000	425.3102	821.3580	1183.2729	(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	89.4769	89.4120	89.2743	88.9601	88.3326	86.7000	86.7000	86.7000	86.7000	89.0119	89.3655	89.5003	(216)
Fuel for water heating, kWh/month	210.5031	184.8928	192.6369	170.7344	166.6120	148.9205	140.4217	157.6948	158.5610	177.0642	189.6928	204.5255	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													5713.1301 (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 * 1080 * 1.00) =													-699.5320 (233)
Total delivered energy for all uses													7647.9074 (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	5713.1301	0.2160	1234.0361 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2102.2596	0.2160	454.0881 (264)
Space and water heating			1688.1242 (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	-699.5320	0.5190	-363.0571 (269)
Total CO2, kg/year			1601.2009 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9200 (273)

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

DER		12.9200 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		28.3131 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		28.3131 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	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)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2451	1.2414	1.2378	1.2208	1.2176	1.2028	1.2028	1.2001	1.2085	1.2176	1.2240	1.2308	(40)
HLP (average)												1.2208	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

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

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

5. Internal gains (see Table 5 and 5a)												
Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	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)
Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	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)
	477.2140	474.9641	458.1618	430.7730	401.8399	374.2041	356.9190	364.1598	379.0275	406.6505	438.4387	462.7660 (73)

6. Solar gains												
[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
North				2.7000	10.6334		0.6300		0.7000		0.7700	8.7742 (74)
East				12.1200	19.6403		0.6300		0.7000		0.7700	72.7481 (76)
South				4.5200	46.7521		0.6300		0.7000		0.7700	64.5819 (78)
West				11.6600	19.6403		0.6300		0.7000		0.7700	69.9870 (80)
Solar gains	216.0913	401.7568	623.0592	868.6848	1042.2303	1060.0674	1011.8328	881.8402	709.8077	465.3597	265.3497	180.4978 (83)
Total gains	693.3053	876.7209	1081.2210	1299.4578	1444.0702	1434.2715	1368.7518	1246.0000	1088.8353	872.0103	703.7884	643.2638 (84)

7. Mean internal temperature (heating season)												
Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	55.7740	55.9399	56.1034	56.8846	57.0331	57.7351	57.7351	57.8670	57.4627	57.0331	56.7334	56.4234
util living area	4.7183	4.7293	4.7402	4.7923	4.8022	4.8490	4.8490	4.8578	4.8308	4.8022	4.7822	4.7616
	0.9985	0.9952	0.9829	0.9350	0.8157	0.6314	0.4722	0.5354	0.8063	0.9727	0.9965	0.9990 (86)
MIT	19.5959	19.8039	20.1334	20.5391	20.8310	20.9634	20.9927	20.9870	20.8832	20.4599	19.9476	19.5660 (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	0.9936	0.9768	0.9122	0.7587	0.5384	0.3598	0.4166	0.7251	0.9590	0.9950	0.9986 (89)
MIT 2	18.0151	18.3204	18.7994	19.3777	19.7491	19.8950	19.9152	19.9150	19.8238	19.2829	18.5409	17.9792 (90)
Living area fraction	18.2373	18.5289	18.9869	19.5409	19.9011	20.0452	20.0666	20.0656	19.9727	19.4483	18.7385	18.2022 (92)
Temperature adjustment	18.2373	18.5289	18.9869	19.5409	19.9011	20.0452	20.0666	20.0656	19.9727	19.4483	18.7385	18.2022 (93)

8. Space heating requirement												
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9968	0.9905	0.9700	0.9029	0.7584	0.5500	0.3756	0.4332	0.7302	0.9511	0.9926	0.9977 (94)
Ext temp.	691.0546	868.4202	1048.7320	1173.3083	1095.1938	788.7909	514.0474	539.7584	795.0539	829.3493	698.5648	641.7812 (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	2151.2920	2097.4566	1916.0989	1610.4156	1237.9447	811.9411	516.9199	545.3416	879.8424	1335.6272	1766.0929	2136.4393 (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	1086.4166	825.9124	645.3209	314.7172	106.2067	0.0000	0.0000	0.0000	0.0000	376.6707	768.6203	1112.0257 (98)
												5235.8905 (98)
												42.2351 (99)

8c. Space cooling requirement

Not applicable

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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													5605.8785 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1086.4166	825.9124	645.3209	314.7172	106.2067	0.0000	0.0000	0.0000	0.0000	376.6707	768.6203	1112.0257	(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)	1163.1869	884.2746	690.9218	336.9563	113.7116	0.0000	0.0000	0.0000	0.0000	403.2877	822.9339	1190.6057	(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	88.5373	88.3022	87.7690	86.4316	83.8324	80.3000	80.3000	80.3000	80.3000	86.7713	88.1251	88.6088	(216)
Fuel for water heating, kWh/month	246.4811	217.7994	230.0602	209.3307	209.2309	192.3853	184.3198	205.4734	207.4428	216.2188	225.2330	240.3258	(219)
Water heating fuel used												2584.3012	(219)
Annual totals kWh/year													
Space heating fuel - main system												5605.8785	(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												8722.2293	(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	5605.8785	0.2160	1210.8698 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2584.3012	0.2160	558.2091 (264)
Space and water heating			1769.0788 (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			2045.2126 (272)
Emissions per m2 for space and water heating			14.2702 (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) = (14.2702 * 1.00) + 1.9134 + 0.3140, rounded to 2 d.p.			16.5000 (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	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					4.5500
Infiltration rate					0.3623 (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) =	0.3623 (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	0.4619	0.4528	0.4438	0.3985	0.3894	0.3441	0.3441	0.3351	0.3623	0.3894	0.4075	0.4257 (22b)
Effective ac	0.6067	0.6025	0.5985	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (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	0.1800	11.2482	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) =		94.2836		(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) = 105.6350 (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	59.4239	59.0182	58.6205	56.7526	56.4031	54.7762	54.7762	54.4750	55.4029	56.4031	57.1101	57.8493 (38)
Heat transfer coeff	165.0590	164.6532	164.2555	162.3876	162.0382	160.4113	160.4113	160.1100	161.0379	162.0382	162.7452	163.4843 (39)
Average = Sum(39)m / 12 =												162.3860 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3314	1.3282	1.3250	1.3099	1.3071	1.2940	1.2940	1.2915	1.2990	1.3071	1.3128	1.3187 (40)
HLP (average)												1.3099 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North					2.8400	10.6334	0.7100	0.7000	0.7700		10.4011 (74)		
East					6.9600	19.6403	0.7100	0.7000	0.7700		47.0811 (76)		
South					4.7600	46.7521	0.7100	0.7000	0.7700		76.6474 (78)		
West					12.2900	19.6403	0.7100	0.7000	0.7700		83.1359 (80)		
East					5.8000	19.6403	0.7100	0.7000	0.7700		39.2342 (76)		
Solar gains	256.4997	476.8882	739.5817	1031.1452	1237.1435	1258.3136	1201.0598	1046.7600	842.5549	552.3874	314.9701	214.2497	(83)
Total gains	686.6116	905.6051	1153.2714	1419.8594	1599.1102	1595.5530	1522.8893	1372.7253	1181.9156	916.8732	708.4236	630.7649	(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	29.5249	29.5976	29.6693	30.0105	30.0753	30.3803	30.3803	30.4375	30.2621	30.0753	29.9446	29.8092	
alpha	2.9683	2.9732	2.9780	3.0007	3.0050	3.0254	3.0254	3.0292	3.0175	3.0050	2.9963	2.9873	
util living area	0.9878	0.9726	0.9370	0.8561	0.7276	0.5707	0.4380	0.4955	0.7274	0.9198	0.9786	0.9905	(86)
MIT	18.7183	19.0549	19.5690	20.1726	20.6205	20.8712	20.9571	20.9375	20.7216	20.0697	19.2690	18.6626	(87)
Th 2	19.8163	19.8188	19.8213	19.8331	19.8353	19.8456	19.8456	19.8475	19.8416	19.8353	19.8308	19.8262	(88)
util rest of house	0.9852	0.9669	0.9238	0.8267	0.6739	0.4884	0.3330	0.3865	0.6528	0.8966	0.9732	0.9884	(89)
MIT 2	17.7471	18.0817	18.5866	19.1688	19.5695	19.7767	19.8306	19.8237	19.6722	19.0901	18.3055	17.6988	(90)
Living area fraction	17.8836	18.2185	18.7246	19.3099	19.7172	19.9305	19.9889	19.9802	19.8196	19.2277	18.4409	17.8342	(92)
MIT	17.8836	18.2185	18.7246	19.3099	19.7172	19.9305	19.9889	19.9802	19.8196	19.2277	18.4409	17.8342	(93)
Temperature adjustment	17.8836	18.2185	18.7246	19.3099	19.7172	19.9305	19.9889	19.9802	19.8196	19.2277	18.4409	17.8342	(93)
adjusted MIT	17.8836	18.2185	18.7246	19.3099	19.7172	19.9305	19.9889	19.9802	19.8196	19.2277	18.4409	17.8342	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	672.2779	866.0886	1047.4659	1151.8026	1068.0031	789.6403	527.8768	548.8026	769.6936	807.9357	683.1012	620.2817	(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	2242.0929	2192.9303	2007.9658	1690.4344	1299.0850	855.0715	543.6159	573.2252	921.0758	1398.0218	1845.6800	2228.9824	(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	1167.9423	891.6377	714.6119	387.8149	171.9250	0.0000	0.0000	0.0000	0.0000	439.0240	837.0567	1196.8733	(98)
Space heating												5806.8857	(98)
Space heating per m2												46.8411	(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	

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	1507.8659	1187.0434	1216.8359	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8431	0.8928	0.8637	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1271.3185	1059.8060	1050.9617	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1981.1974	1893.6376	1720.2798	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	511.1128	620.3708	497.9727	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												1629.4562	(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	127.7782	155.0927	124.4932	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												407.3641	(107)
Space cooling per m2												3.2860	(108)
Energy for space heating												46.8411	(99)
Energy for space cooling												3.2860	(108)
Total												50.1270	(109)
Dwelling Fabric Energy Efficiency (DFEE)												50.1	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER 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, m ²)			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/m ² K							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)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2451	1.2414	1.2378	1.2208	1.2176	1.2028	1.2028	1.2001	1.2085	1.2176	1.2240	1.2308 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7930	108.6914	104.5899	100.4883	96.3867	92.2852	92.2852	96.3867	100.4883	104.5899	108.6914	112.7930 (44)
Energy conte	167.2687	146.2943	150.9626	131.6129	126.2857	108.9749	100.9813	115.8775	117.2615	136.6569	149.1717	161.9908 (45)
Energy content (annual)										Total = Sum(45)m =		1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

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

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.7000	10.6334	0.6300	0.7000	0.7700	8.7742 (74)
East	12.1200	19.6403	0.6300	0.7000	0.7700	72.7481 (76)
South	4.5200	46.7521	0.6300	0.7000	0.7700	64.5819 (78)
West	11.6600	19.6403	0.6300	0.7000	0.7700	69.9870 (80)

Solar gains	216.0913	401.7568	623.0592	868.6848	1042.2303	1060.0674	1011.8328	881.8402	709.8077	465.3597	265.3497	180.4978	(83)
Total gains	646.2032	830.4737	1036.7489	1257.3990	1404.1970	1397.3068	1333.6623	1207.8055	1049.1684	829.8455	658.8031	597.0129	(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	0.9962	0.9855	0.9417	0.8275	0.6448	0.4838	0.5505	0.8223	0.9774	0.9974	0.9993	(86)
MIT	19.5611	19.7702	20.1028	20.5160	20.8191	20.9600	20.9918	20.9854	20.8718	20.4322	19.9145	19.5316	(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	0.9949	0.9803	0.9207	0.7720	0.5512	0.3690	0.4293	0.7435	0.9657	0.9962	0.9990	(89)
MIT 2	18.5733	18.7840	19.1156	19.5238	19.7902	19.9006	19.9158	19.9161	19.8451	19.4544	18.9394	18.5528	(90)
Living area fraction									fLA = Living area / (4) =			0.1405	(91)
MIT	18.7121	18.9226	19.2543	19.6632	19.9348	20.0495	20.0670	20.0663	19.9894	19.5918	19.0764	18.6904	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7121	18.9226	19.2543	19.6632	19.9348	20.0495	20.0670	20.0663	19.9894	19.5918	19.0764	18.6904	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9932	0.9762	0.9151	0.7736	0.5632	0.3852	0.4463	0.7499	0.9612	0.9950	0.9986	(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	2224.5856	2158.0416	1957.1413	1628.9212	1243.0224	812.5868	516.9790	545.4496	882.3396	1357.2956	1817.3706	2210.9254	(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	1175.3168	895.8937	703.0953	344.3779	116.5664	0.0000	0.0000	0.0000	0.0000	416.3949	836.5363	1201.3873	(98)
Space heating												5689.5685	(98)
Space heating per m2										(98) / (4) =		45.8947	(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	0.9066	0.9504	0.9273	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1270.7259	1048.6477	1048.4296	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1749.4810	1672.4632	1527.5164	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	344.7037	464.1188	356.4406	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												1165.2630 (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	86.1759	116.0297	89.1101	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												291.3158 (107)
Space cooling per m2												2.3499 (108)
Energy for space heating												45.8947 (99)
Energy for space cooling												2.3499 (108)
Total												48.2446 (109)
Target Fabric Energy Efficiency (TFEE)												55.5 (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	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					4.5500
Infiltration rate					0.3623 (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) =	0.3623 (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	0.3804	0.3532	0.3623	0.3441	0.3441	0.3351	0.3260	0.3170	0.3079	0.3351	0.3170	0.3351 (22b)
Effective ac	0.5723	0.5624	0.5656	0.5592	0.5592	0.5561	0.5531	0.5502	0.5474	0.5561	0.5502	0.5561 (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	0.1800	11.2482	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) =		94.2836		(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) = 105.6350 (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	56.0617	55.0856	55.4029	54.7762	54.7762	54.4750	54.1817	53.8965	53.6193	54.4750	53.8965	54.4750 (38)
Heat transfer coeff	161.6967	160.7206	161.0379	160.4113	160.4113	160.1100	159.8168	159.5315	159.2544	160.1100	159.5315	160.1100 (39)
Average = Sum(39)m / 12 =												160.2285 (39)
HLP	1.3043	1.2964	1.2990	1.2940	1.2940	1.2915	1.2892	1.2869	1.2846	1.2915	1.2869	1.2915 (40)
HLP (average)												1.2925 (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 HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m												
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602 (61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510 (64)
RHI water heating demand												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
North				2.8400	13.4839		0.7100		0.7000		0.7700		13.1893 (74)
East				6.9600	25.1925		0.7100		0.7000		0.7700		60.3908 (76)
South				4.7600	56.7559		0.7100		0.7000		0.7700		93.0481 (78)
West				12.2900	25.1925		0.7100		0.7000		0.7700		106.6384 (80)
East				5.8000	25.1925		0.7100		0.7000		0.7700		50.3257 (76)
Solar gains	323.5922	512.6217	802.0586	1125.2147	1282.9699	1417.4918	1342.3808	1198.8798	965.1539	640.8880	396.2125	265.5945	(83)
Total gains	1019.0979	1203.0130	1465.4539	1746.4279	1860.4406	1956.0882	1858.4469	1724.3678	1515.0824	1233.2336	1035.7790	941.4146	(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	31.0893	31.2781	31.2165	31.3385	31.3385	31.3974	31.4550	31.5113	31.5661	31.3974	31.5113	31.3974
alpha	3.0726	3.0852	3.0811	3.0892	3.0892	3.0932	3.0970	3.1008	3.1044	3.0932	3.1008	3.0932
util living area	0.9651	0.9441	0.8878	0.7757	0.6287	0.4419	0.3277	0.3509	0.5859	0.8316	0.9394	0.9709 (86)
MIT	19.2450	19.4934	19.9655	20.4677	20.7894	20.9476	20.9845	20.9814	20.8741	20.4440	19.7843	19.2087 (87)
Th 2	19.8374	19.8436	19.8416	19.8456	19.8456	19.8475	19.8493	19.8511	19.8529	19.8475	19.8511	19.8475 (88)
util rest of house	0.9580	0.9330	0.8664	0.7359	0.5664	0.3610	0.2343	0.2518	0.5014	0.7894	0.9250	0.9648 (89)
MIT 2	17.5537	17.9115	18.5730	19.2498	19.6473	19.8126	19.8432	19.8436	19.7556	19.2440	18.3390	17.5085 (90)
Living area fraction	17.7914	18.1338	18.7687	19.4209	19.8077	19.9721	20.0036	20.0035	fLA = Living area / (4) =	19.9128	19.4126	18.5421
MIT	17.7914	18.1338	18.7687	19.4209	19.8077	19.9721	20.0036	20.0035	19.9128	19.4126	18.5421	17.7474 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6414	17.9838	18.6187	19.2709	19.6577	19.8221	19.8536	19.8535	19.7628	19.2626	18.3921	17.5974 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	956.3010	1093.4233	1228.3400	1245.5247	1033.2383	702.5885	436.1766	434.5370	748.7268	941.4628	932.1614	891.6680	(94)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	2060.2368	2038.5470	1871.0472	1567.3615	1148.1834	724.0373	440.0649	439.2696	806.2720	1258.8780	1673.8263	2016.9744	(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	821.3283	635.1231	478.1742	231.7225	85.5192	0.0000	0.0000	0.0000	0.0000	236.1570	533.9987	837.2280	(98)
Space heating												3859.2508	(98)
RHI space heating demand												3859	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1348 (8)
Pressure test					Yes
Measured/design AP50					4.5500
Infiltration rate					0.3623 (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) =	0.3623 (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	0.4619	0.4528	0.4438	0.3985	0.3894	0.3441	0.3441	0.3351	0.3623	0.3894	0.4075	0.4257 (22b)
Effective ac	0.6067	0.6025	0.5985	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (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	0.1800	11.2482	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) =	94.2836		(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) = 105.6350 (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	59.4239	59.0182	58.6205	56.7526	56.4031	54.7762	54.7762	54.4750	55.4029	56.4031	57.1101	57.8493 (38)
Heat transfer coeff	165.0590	164.6532	164.2555	162.3876	162.0382	160.4113	160.4113	160.1100	161.0379	162.0382	162.7452	163.4843 (39)
Average = Sum(39)m / 12 =												162.3860 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3314	1.3282	1.3250	1.3099	1.3071	1.2940	1.2940	1.2915	1.2990	1.3071	1.3128	1.3187 (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)
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	(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)

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

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

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					2.8400	10.6334	0.7100	0.7000			0.7700			10.4011 (74)
East					6.9600	19.6403	0.7100	0.7000			0.7700			47.0811 (76)
South					4.7600	46.7521	0.7100	0.7000			0.7700			76.6474 (78)
West					12.2900	19.6403	0.7100	0.7000			0.7700			83.1359 (80)
East					5.8000	19.6403	0.7100	0.7000			0.7700			39.2342 (76)
Solar gains	256.4997	476.8882	739.5817	1031.1452	1237.1435	1258.3136	1201.0598	1046.7600	842.5549	552.3874	314.9701	214.2497 (83)		
Total gains	952.0053	1167.2796	1402.9770	1652.3584	1814.6141	1796.9101	1717.1259	1572.2480	1392.4834	1144.7330	954.5367	890.0699 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	30.4560	30.5311	30.6050	30.9570	31.0238	31.3385	31.3385	31.3974	31.2165	31.0238	30.8890	30.7494	
alpha	3.0304	3.0354	3.0403	3.0638	3.0683	3.0892	3.0892	3.0932	3.0811	3.0683	3.0593	3.0500	
util living area	0.9735	0.9518	0.9068	0.8149	0.6803	0.5230	0.3951	0.4435	0.6643	0.8765	0.9575	0.9780	(86)
MIT	19.0314	19.3418	19.8043	20.3309	20.7050	20.9056	20.9702	20.9573	20.7981	20.2617	19.5424	18.9749	(87)
Th 2	19.8163	19.8188	19.8213	19.8331	19.8353	19.8456	19.8456	19.8475	19.8416	19.8353	19.8308	19.8262	(88)
util rest of house	0.9681	0.9423	0.8886	0.7803	0.6240	0.4433	0.2979	0.3420	0.5862	0.8444	0.9474	0.9735	(89)
MIT 2	17.2328	17.6794	18.3353	19.0628	19.5405	19.7740	19.8310	19.8248	19.6694	18.9950	17.9820	17.1572	(90)
Living area fraction	17.4855	17.9130	18.5418	19.2410	19.7041	19.9330	19.9911	19.9839	19.8280	19.1730	18.2013	17.4126	(91)
MIT	17.4855	17.9130	18.5418	19.2410	19.7041	19.9330	19.9911	19.9839	19.8280	19.1730	18.2013	17.4126	(92)
Temperature adjustment	17.3355	17.7630	18.3918	19.0910	19.5541	19.7830	19.8411	19.8339	19.6780	19.0230	18.0513	17.2626	(93)
adjusted MIT	17.3355	17.7630	18.3918	19.0910	19.5541	19.7830	19.8411	19.8339	19.6780	19.0230	18.0513	17.2626	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9511	0.9191	0.8603	0.7545	0.6090	0.4387	0.2975	0.3408	0.5739	0.8160	0.9253	0.9584	0.9584	(94)
Useful gains	905.4130	1072.8661	1206.9742	1246.7103	1105.1090	788.2621	510.7933	535.7512	799.1064	934.1344	883.2560	853.0236	(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	2151.6304	2117.9335	1953.2871	1654.8974	1272.6640	831.4187	519.9062	549.8055	898.2724	1364.8462	1782.2667	2135.5300	(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	927.1857	702.2853	555.2568	293.8947	124.6609	0.0000	0.0000	0.0000	0.0000	320.4496	647.2877	954.1847	(98)
Space heating													4525.2055 (98)
Space heating per m2													(98) / (4) = 36.5024 (99)

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													5028.0061 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	927.1857	702.2853	555.2568	293.8947	124.6609	0.0000	0.0000	0.0000	0.0000	320.4496	647.2877	954.1847	(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)	1030.2064	780.3170	616.9520	326.5497	138.5122	0.0000	0.0000	0.0000	0.0000	356.0551	719.2086	1060.2053	(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	89.4253	89.3520	89.1971	88.8478	88.1828	86.7000	86.7000	86.7000	86.7000	88.8846	89.2946	89.4520	(216)
Fuel for water heating, kWh/month	210.6245	185.0169	192.8036	170.9503	166.8950	148.9205	140.4217	157.6948	158.5610	177.3177	189.8433	204.6361	(219)
Water heating fuel used												2103.6853	(219)
Annual totals kWh/year													
Space heating fuel - main system												5028.0061	(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 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6964.2091	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5028.0061	3.4800	174.9746 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2103.6853	3.4800	73.2082 (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	-699.5320	13.1900	-92.2683 (252)
Total energy cost			346.0919 (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] =	0.8603 (257)
SAP value		87.9993
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	5028.0061	0.2160	1086.0493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2103.6853	0.2160	454.3960 (264)
Space and water heating			1540.4454 (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	-699.5320	0.5190	-363.0571 (269)
Total kg/year			1453.5220 (272)
CO2 emissions per m2			11.7200 (273)
EI value			88.4730
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8829 = 3.942$, 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		(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					4.5500
Infiltration rate					0.3623 (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) =	0.3623 (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												
Effective ac	0.3804	0.3532	0.3623	0.3441	0.3441	0.3351	0.3260	0.3170	0.3079	0.3351	0.3170	0.3351 (22b)
	0.5723	0.5624	0.5656	0.5592	0.5592	0.5561	0.5531	0.5502	0.5474	0.5561	0.5502	0.5561 (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	0.1800	11.2482	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) =		94.2836		(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) = 105.6350 (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	56.0617	55.0856	55.4029	54.7762	54.7762	54.4750	54.1817	53.8965	53.6193	54.4750	53.8965	54.4750 (38)
Heat transfer coeff	161.6967	160.7206	161.0379	160.4113	160.4113	160.1100	159.8168	159.5315	159.2544	160.1100	159.5315	160.1100 (39)
Average = Sum(39)m / 12 =												160.2285 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3043	1.2964	1.2990	1.2940	1.2940	1.2915	1.2892	1.2869	1.2846	1.2915	1.2869	1.2915 (40)
HLP (average)												1.2925 (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 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	(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)

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	(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	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	-115.0974	(71)
Water heating gains (Table 5)												
81.8381	79.4618	74.5272	67.8187	63.4566	57.3180	52.1067	58.7906	61.1697	68.1132	75.9537	79.4718	(72)
Total internal gains	695.5056	690.3913	663.3953	621.2132	577.4706	538.5964	516.0660	525.4880	549.9285	592.3455	639.5665	675.8202 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				2.8400	13.4839	0.7100	0.7000	0.7700	13.1893 (74)			
East				6.9600	25.1925	0.7100	0.7000	0.7700	60.3908 (76)			
South				4.7600	56.7559	0.7100	0.7000	0.7700	93.0481 (78)			
West				12.2900	25.1925	0.7100	0.7000	0.7700	106.6384 (80)			
East				5.8000	25.1925	0.7100	0.7000	0.7700	50.3257 (76)			
Solar gains	323.5922	512.6217	802.0586	1125.2147	1282.9699	1417.4918	1342.3808	1198.8798	965.1539	640.8880	396.2125	265.5945 (83)
Total gains	1019.0979	1203.0130	1465.4539	1746.4279	1860.4406	1956.0882	1858.4469	1724.3678	1515.0824	1233.2336	1035.7790	941.4146 (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	31.0893	31.2781	31.2165	31.3385	31.3385	31.3974	31.4550	31.5113	31.5661	31.3974	31.5113	31.3974	
alpha	3.0726	3.0852	3.0811	3.0892	3.0892	3.0932	3.0970	3.1008	3.1044	3.0932	3.1008	3.0932	
util living area	0.9651	0.9441	0.8878	0.7757	0.6287	0.4419	0.3277	0.3509	0.5859	0.8316	0.9394	0.9709 (86)	
MIT	19.2450	19.4934	19.9655	20.4677	20.7894	20.9476	20.9845	20.9814	20.8741	20.4440	19.7843	19.2087 (87)	
Th 2	19.8374	19.8436	19.8416	19.8456	19.8456	19.8475	19.8493	19.8511	19.8529	19.8475	19.8511	19.8475 (88)	
util rest of house	0.9580	0.9330	0.8664	0.7359	0.5664	0.3610	0.2343	0.2518	0.5014	0.7894	0.9250	0.9648 (89)	
MIT 2	17.5537	17.9115	18.5730	19.2498	19.6473	19.8126	19.8432	19.8436	19.7556	19.2440	18.3390	17.5085 (90)	
Living area fraction	17.7914	18.1338	18.7687	19.4209	19.8077	19.9721	20.0036	20.0035	fLA = Living area / (4) =				0.1405 (91)
MIT	17.7914	18.1338	18.7687	19.4209	19.8077	19.9721	20.0036	20.0035	19.9128	19.4126	18.5421	17.7474 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.6414	17.9838	18.6187	19.2709	19.6577	19.8221	19.8536	19.8535	19.7628	19.2626	18.3921	17.5974 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	956.3010	1093.4233	1228.3400	1245.5247	1033.2383	702.5885	436.1766	434.5370	748.7268	941.4628	932.1614	891.6680	(94)
Ext temp.	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000	(96)
Heat loss rate W	2060.2368	2038.5470	1871.0472	1567.3615	1148.1834	724.0373	440.0649	439.2696	806.2720	1258.8780	1673.8263	2016.9744	(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	821.3283	635.1231	478.1742	231.7225	85.5192	0.0000	0.0000	0.0000	0.0000	236.1570	533.9987	837.2280	(98)
Space heating												3859.2508	(98)
Space heating per m2												(98) / (4) = 31.1305	(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												4288.0565	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	821.3283	635.1231	478.1742	231.7225	85.5192	0.0000	0.0000	0.0000	0.0000	236.1570	533.9987	837.2280	(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)	912.5870	705.6924	531.3046	257.4694	95.0213	0.0000	0.0000	0.0000	0.0000	262.3966	593.3319	930.2533	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(64)
Efficiency of water heater	89.3655	89.2980	89.1029	88.6638	87.8843	86.7000	86.7000	86.7000	86.7000	88.6494	89.1821	89.3896	(216)
(217)m													(217)
Fuel for water heating, kWh/month	210.7655	185.1287	193.0076	171.3050	167.4618	148.9205	140.4217	157.6948	158.5610	177.7881	190.0829	204.7789	(219)
Water heating fuel used												2105.9164	(219)
Annual totals kWh/year													
Space heating fuel - main system												4288.0565	(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 * 1208 * 1.00) =										-782.8819		-782.8819	(233)
Total delivered energy for all uses												6143.1407	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4288.0565	3.9200	168.0918 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2105.9164	3.9200	82.5519 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	457.0496	16.9600	77.5156 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-782.8819	16.9600	-132.7768 (252)
Total energy cost			296.1026 (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	4288.0565	0.2160	926.2202 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2105.9164	0.2160	454.8779 (264)
Space and water heating			1381.0981 (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	-782.8819	0.5190	-406.3157 (269)
Total kg/year			1250.9162 (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	4288.0565	1.2200	5231.4289 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2105.9164	1.2200	2569.2180 (264)
Space and water heating			7800.6470 (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	-782.8819	3.0700	-2403.4473 (269)
Primary energy kWh/year			7030.5920 (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

56.7120 (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	-£ 33	-200 kg (16.0%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£33	1.62 kg/m ²	B 89 B 90
Total Savings	£33	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 443 TEST (28 May 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£90	£99	-£8
Mains gas	£339	£298	£41
Space heating	£269	£269	£0
Water heating	£83	£50	£33
Lighting	£78	£78	£0
Generated (PV)	-£133	-£133	£0
Total cost of fuels	£296	£264	£33
Total cost of uses	£297	£264	£33
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	8 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					4.5500
Infiltration rate					0.3623 (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) =	0.3623 (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	0.4619	0.4528	0.4438	0.3985	0.3894	0.3441	0.3441	0.3351	0.3623	0.3894	0.4075	0.4257 (22b)
Effective ac	0.6067	0.6025	0.5985	0.5794	0.5758	0.5592	0.5592	0.5561	0.5656	0.5758	0.5830	0.5906 (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	0.1800	11.2482	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 (31)
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) =	94.2836		(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) = 105.6350 (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	59.4239	59.0182	58.6205	56.7526	56.4031	54.7762	54.7762	54.4750	55.4029	56.4031	57.1101	57.8493 (38)
Heat transfer coeff	165.0590	164.6532	164.2555	162.3876	162.0382	160.4113	160.4113	160.1100	161.0379	162.0382	162.7452	163.4843 (39)
Average = Sum(39)m / 12 =												162.3860 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3314	1.3282	1.3250	1.3099	1.3071	1.2940	1.2940	1.2915	1.2990	1.3071	1.3128	1.3187 (40)
HLP (average)												1.3099 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum (45)m =	1613.3389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	25.0903	21.9441	22.6444	19.7419	18.9429	16.3462	15.1472	17.3816	17.5892	20.4985	22.3758	24.2986	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	21.0828	19.0220	21.0127	20.2726	20.8870	20.1391	20.7643	20.8439	20.2109	20.9512	20.3481	21.0602	(61)
Total heat required for water heating calculated for each month	188.3516	165.3163	171.9753	151.8855	147.1727	129.1141	121.7456	136.7214	137.4724	157.6081	169.5199	183.0510	(62)
Aperture area of solar collector												3.0000	(H1)
Zero-loss collector efficiency												0.7000	(H2)
Collector heat loss coefficient												1.8000	(H3)
Collector 2nd order heat loss coefficient												0.0050	(H3a)
Collector effective heat loss coefficient												1.8063	(H3b)
Collector performance ratio												2.5804	(H4)
Annual solar radiation per m2												1079.5246	(H5)
Overshading factor												0.8000	(H6)
Solar energy available												1813.6014	(H7)
Adjustment factor for showers												1.0000	(H7a)
Solar-to-load ratio												1.1241	(H8)
Utilisation factor												0.5892	(H9)
Collector performance factor												0.8793	(H10)
Dedicated solar storage volume												75.0000	(H11)
Effective solar volume												75.0000	(H13)
Daily hot water demand												102.5391	(H14)
Volume ratio Veff/V												0.7314	(H15)
Solar storage volume factor												0.9374	(H16)
Solar input												-880.7738	(H17)
Solar input	-25.5407	-42.6201	-72.5868	-97.2807	-120.1821	-118.1581	-116.5966	-101.8710	-79.7855	-54.4841	-30.2949	-21.3732	(63)
												Solar input (sum of months) = Sum (63)m =	-880.7738 (63)
Output from w/h	162.8109	122.6962	99.3885	54.6048	26.9906	10.9560	5.1490	34.8503	57.6869	103.1241	139.2249	161.6778	(64)
												Total per year (kWh/year) = Sum (64)m =	979.1600 (64)
Heat gains from water heating, kWh/month	60.8876	53.3984	55.4483	48.8294	47.2117	41.2690	38.7674	43.7402	44.0422	50.6762	54.6866	59.1270	(65)

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

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

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					2.8400	10.6334		0.7100	0.7000	0.7700		10.4011 (74)	
East					6.9600	19.6403		0.7100	0.7000	0.7700		47.0811 (76)	
South					4.7600	46.7521		0.7100	0.7000	0.7700		76.6474 (78)	
West					12.2900	19.6403		0.7100	0.7000	0.7700		83.1359 (80)	
East					5.8000	19.6403		0.7100	0.7000	0.7700		39.2342 (76)	

Solar gains	256.4997	476.8882	739.5817	1031.1452	1237.1435	1258.3136	1201.0598	1046.7600	842.5549	552.3874	314.9701	214.2497	(83)
Total gains	952.0053	1167.2796	1402.9770	1652.3584	1814.6141	1796.9101	1717.1259	1572.2480	1392.4834	1144.7330	954.5367	890.0699	(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	30.4560	30.5311	30.6050	30.9570	31.0238	31.3385	31.3385	31.3974	31.2165	31.0238	30.8890	30.7494	
alpha	3.0304	3.0354	3.0403	3.0638	3.0683	3.0892	3.0892	3.0932	3.0811	3.0683	3.0593	3.0500	
util living area	0.9735	0.9518	0.9068	0.8149	0.6803	0.5230	0.3951	0.4435	0.6643	0.8765	0.9575	0.9780	(86)
MIT	19.0314	19.3418	19.8043	20.3309	20.7050	20.9056	20.9702	20.9573	20.7981	20.2617	19.5424	18.9749	(87)
Th 2	19.8163	19.8188	19.8213	19.8331	19.8353	19.8456	19.8456	19.8475	19.8416	19.8353	19.8308	19.8262	(88)
util rest of house	0.9681	0.9423	0.8886	0.7803	0.6240	0.4433	0.2979	0.3420	0.5862	0.8444	0.9474	0.9735	(89)
MIT 2	17.2328	17.6794	18.3353	19.0628	19.5405	19.7740	19.8310	19.8248	19.6694	18.9950	17.9820	17.1572	(90)
Living area fraction	17.4855	17.9130	18.5418	19.2410	19.7041	19.9330	19.9911	19.9839	19.8280	19.1730	18.2013	17.4126	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.3355	17.7630	18.3918	19.0910	19.5541	19.7830	19.8411	19.8339	19.6780	19.0230	18.0513	17.2626	(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	0.9511	0.9191	0.8603	0.7545	0.6090	0.4387	0.2975	0.3408	0.5739	0.8160	0.9253	0.9584	(94)
Useful gains	905.4130	1072.8661	1206.9742	1246.7103	1105.1090	788.2621	510.7933	535.7512	799.1064	934.1344	883.2560	853.0236	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Month fracti	2151.6304	2117.9335	1953.2871	1654.8974	1272.6640	831.4187	519.9062	549.8055	898.2724	1364.8462	1782.2667	2135.5300	(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	927.1857	702.2853	555.2568	293.8947	124.6609	0.0000	0.0000	0.0000	0.0000	320.4496	647.2877	954.1847	(98)
Space heating per m2												4525.2055	(98)
											(98) / (4) =	36.5024	(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													5028.0061 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	927.1857	702.2853	555.2568	293.8947	124.6609	0.0000	0.0000	0.0000	0.0000	320.4496	647.2877	954.1847	(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)	1030.2064	780.3170	616.9520	326.5497	138.5122	0.0000	0.0000	0.0000	0.0000	356.0551	719.2086	1060.2053	(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	89.4912	89.4934	89.4829	89.4664	89.3944	86.7000	86.7000	86.7000	86.7000	89.1737	89.3977	89.5064	(216)
Fuel for water heating, kWh/month	181.9295	137.1009	111.0698	61.0339	30.1927	12.6366	5.9389	40.1965	66.5362	115.6441	155.7366	180.6327	(219)
Water heating fuel used												1098.6484	(219)
Annual totals kWh/year													
Space heating fuel - main system												5028.0061	(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 * 1080 * 1.00) =										-699.5320		-699.5320	(233)
Total delivered energy for all uses												6009.1722	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5028.0061	3.4800	174.9746	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1098.6484	3.4800	38.2330	(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	-699.5320	13.1900	-92.2683	(252)
Total energy cost			317.7117	(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] =	0.7897 (257)
SAP value		88.9834
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	5028.0061	0.2160	1086.0493	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1098.6484	0.2160	237.3080	(264)
Space and water heating			1323.3574	(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	-699.5320	0.5190	-363.0571	(269)
Total kg/year			1262.3840	(272)
CO2 emissions per m2			10.1800	(273)
EI value			89.9888	
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					4.5500
Infiltration rate					0.3623 (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) =	0.3623 (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	0.3804	0.3532	0.3623	0.3441	0.3441	0.3351	0.3260	0.3170	0.3079	0.3351	0.3170	0.3351 (22b)
Effective ac	0.5723	0.5624	0.5656	0.5592	0.5592	0.5561	0.5531	0.5502	0.5474	0.5561	0.5502	0.5561 (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	0.1800	11.2482	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) =		94.2836		(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/m ² K							145.9817 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.3514 (36)
Total fabric heat loss							(33) + (36) = 105.6350 (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	56.0617	55.0856	55.4029	54.7762	54.7762	54.4750	54.1817	53.8965	53.6193	54.4750	53.8965	54.4750 (38)
Heat transfer coeff	161.6967	160.7206	161.0379	160.4113	160.4113	160.1100	159.8168	159.5315	159.2544	160.1100	159.5315	160.1100 (39)
Average = Sum(39)m / 12 =												160.2285 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3043	1.2964	1.2990	1.2940	1.2940	1.2915	1.2892	1.2869	1.2846	1.2915	1.2869	1.2915 (40)
HLP (average)												1.2925 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

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

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

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					2.8400	13.4839		0.7100	0.7000	0.7700		13.1893 (74)
East					6.9600	25.1925		0.7100	0.7000	0.7700		60.3908 (76)
South					4.7600	56.7559		0.7100	0.7000	0.7700		93.0481 (78)
West					12.2900	25.1925		0.7100	0.7000	0.7700		106.6384 (80)
East					5.8000	25.1925		0.7100	0.7000	0.7700		50.3257 (76)

Solar gains	323.5922	512.6217	802.0586	1125.2147	1282.9699	1417.4918	1342.3808	1198.8798	965.1539	640.8880	396.2125	265.5945 (83)
Total gains	1019.0979	1203.0130	1465.4539	1746.4279	1860.4406	1956.0882	1858.4469	1724.3678	1515.0824	1233.2336	1035.7790	941.4146 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	31.0893	31.2781	31.2165	31.3385	31.3385	31.3974	31.4550	31.5113	31.5661	31.3974	31.5113	31.3974
alpha	3.0726	3.0852	3.0811	3.0892	3.0892	3.0932	3.0970	3.1008	3.1044	3.0932	3.1008	3.0932
util living area	0.9651	0.9441	0.8878	0.7757	0.6287	0.4419	0.3277	0.3509	0.5859	0.8316	0.9394	0.9709 (86)
MIT	19.2450	19.4934	19.9655	20.4677	20.7894	20.9476	20.9845	20.9814	20.8741	20.4440	19.7843	19.2087 (87)
Th 2	19.8374	19.8436	19.8416	19.8456	19.8456	19.8475	19.8493	19.8511	19.8529	19.8475	19.8511	19.8475 (88)
util rest of house	0.9580	0.9330	0.8664	0.7359	0.5664	0.3610	0.2343	0.2518	0.5014	0.7894	0.9250	0.9648 (89)
MIT 2	17.5537	17.9115	18.5730	19.2498	19.6473	19.8126	19.8432	19.8436	19.7556	19.2440	18.3390	17.5085 (90)
Living area fraction	17.7914	18.1338	18.7687	19.4209	19.8077	19.9721	20.0036	20.0035	19.9128	19.4126	18.5421	17.7474 (92)
Temperature adjustment	17.6414	17.9838	18.6187	19.2709	19.6577	19.8221	19.8536	19.8535	19.7628	19.2626	18.3921	17.5974 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9384	0.9089	0.8382	0.7132	0.5554	0.3592	0.2347	0.2520	0.4942	0.7634	0.9000	0.9472 (94)
Useful gains	956.3010	1093.4233	1228.3400	1245.5247	1033.2383	702.5885	436.1766	434.5370	748.7268	941.4628	932.1614	891.6680 (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												
	2060.2368	2038.5470	1871.0472	1567.3615	1148.1834	724.0373	440.0649	439.2696	806.2720	1258.8780	1673.8263	2016.9744 (97a)
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												
	821.3283	635.1231	478.1742	231.7225	85.5192	0.0000	0.0000	0.0000	0.0000	236.1570	533.9987	837.2280 (98)
Space heating												3859.2508 (98)
Space heating per m2												(98) / (4) = 31.1305 (99)

Not applicable

 Fraction of space heat from secondary/supplementary system (Table 11)

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	4288.0565	(211)

[illegible][illegible]

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 * 1208 * 1.00) =	-782.8819	-782.8819 (233)
Total delivered energy for all uses		5144.9562 (238)

	Fuel kWh/year	Fuel price p/kWh £/year	Fuel cost £/year
Space heating - main system 1	4288.0565	3.9200	168.0918 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1057.7319	3.9200	41.4631 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Pump for solar water heating	50.0000	16.9600	8.4800 (249)
Energy for lighting	457.0496	16.9600	77.5156 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-782.8819	16.9600	-132.7768 (252)
Total energy cost			263.4938 (255)

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	4288.0565	0.2160	926.202 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1057.7319	0.2160	228.4701 (264)
Space and water heating			1154.6903 (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	-782.8819	0.5190	-406.3157 (269)
Total kg/year			1050.4584 (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	4288.0565	1.2200	5231.4289 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1057.7319	1.2200	1290.4329 (264)
Space and water heating			6521.8618 (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	-782.8819	3.0700	-2403.4473 (269)
Primary energy kWh/year			5905.3069 (272)
Primary energy kWh/m2/year			47.6350 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	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	105.64 (37)
Summer heat loss coefficient	497.44 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.8400	87.1704	0.7100	0.7000	0.9000	99.6619
East	6.9600	125.2818	0.7100	0.7000	0.9000	351.0254
South	4.7600	118.5567	0.7100	0.7000	0.9000	227.1822
West	12.2900	125.2818	0.7100	0.7000	0.9000	619.8423
East	5.8000	125.2818	0.7100	0.7000	0.9000	292.5212

total: 1590.2330

	Jun	Jul	Aug	
Solar gains	1707	1590	1416	(P3)
Internal gains	536	513	522	
Total summer gains	2243	2103	1938	(P5)
Summer gain/loss ratio	4.51	4.23	3.90	(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	20.89	22.51	22.17	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			