

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-154				Issued on Date	05/12/2019	
Assessment Reference	As Built		Prop Type Ref	P404 - Det (As)			
Property	65, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE						
SAP Rating			88 B	DER	12.62	TER	16.20
Environmental			89 B	% DER<TER	22.12		
CO ₂ Emissions (t/year)			1.21	DFEE	47.13	TFEE	53.08
General Requirements Compliance			Pass	% DFEE<TFEE	11.21		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk					Assessor ID	T511-0001
Client							

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

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DWELLING AS BUILT

Detached House, total floor area 123 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) 16.20 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.62 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (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: 4.82 (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): Slight OK

Based on:

Overshading: Average
Windows facing North East: 11.66 m², No overhang
Windows facing South East: 2.84 m², No overhang
Windows facing South West: 10.05 m², No overhang
Windows facing North West: 2.46 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Door U-value 0.90 W/m²K
Thermal bridging y-value 0.032 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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.3769 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3203 (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	0.4084	0.4004	0.3924	0.3524	0.3444	0.3043	0.3043	0.2963	0.3203	0.3444	0.3604	0.3764 (22b)
Effective ac	0.5834	0.5802	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708 (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)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.5093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9388 (36)
Total fabric heat loss (33) + (36) = 94.7609 (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	56.6782	56.3635	56.0551	54.6064	54.3354	53.0736	53.0736	52.8399	53.5596	54.3354	54.8837	55.4569 (38)
Heat transfer coeff	151.4391	151.1244	150.8160	149.3673	149.0963	147.8345	147.8345	147.6009	148.3205	149.0963	149.6446	150.2178 (39)
Average = Sum(39)m / 12 =												149.3660 (39)
HLP	1.2320	1.2295	1.2269	1.2152	1.2130	1.2027	1.2027	1.2008	1.2066	1.2130	1.2174	1.2221 (40)
HLP (average)												1.2151 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

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Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (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	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1858.6152 (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	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	465.6250	463.3677	446.6062	419.2942	391.0709	364.2113	346.9705	353.5319	367.7401	395.2869	426.9856	451.2268 (73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast	11.6600				11.2829	0.7100	0.7000	0.7700	45.3117 (75)			
Southeast	2.8400				36.7938	0.7100	0.7000	0.7700	35.9901 (77)			
Southwest	4.2500				36.7938	0.7100	0.7000	0.7700	53.8584 (79)			
Northwest	2.4600				11.2829	0.7100	0.7000	0.7700	9.5598 (81)			
Southwest	5.8000				36.7938	0.7100	0.7000	0.7700	73.5009 (79)			
Solar gains	218.2209	389.9370	581.9405	802.1980	972.5945	998.1403	948.7558	816.6517	657.4315	444.0165	264.6975	184.6039 (83)
Total gains	683.8458	853.3046	1028.5467	1221.4922	1363.6654	1362.3516	1295.7263	1170.1836	1025.1716	839.3033	691.6830	635.8306 (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	32.8075	32.8758	32.9430	33.2625	33.3230	33.6074	33.6074	33.6606	33.4973	33.3230	33.2009	33.0742
alpha	3.1872	3.1917	3.1962	3.2175	3.2215	3.2405	3.2405	3.2440	3.2332	3.2215	3.2134	3.2049
util living area	0.9887	0.9768	0.9504	0.8863	0.7694	0.6118	0.4737	0.5340	0.7631	0.9314	0.9804	0.9910 (86)
MIT	18.9318	19.2134	19.6484	20.1875	20.6216	20.8732	20.9587	20.9391	20.7291	20.1374	19.4291	18.8808 (87)
Th 2	19.8945	19.8965	19.8985	19.9079	19.9097	19.9178	19.9178	19.9194	19.9147	19.9097	19.9061	19.9024 (88)
util rest of house	0.9862	0.9719	0.9397	0.8617	0.7204	0.5315	0.3683	0.4256	0.6941	0.9112	0.9755	0.9890 (89)
MIT 2	17.1363	17.5457	18.1729	18.9363	19.5126	19.8157	19.8959	19.8841	19.6664	18.8856	17.8684	17.0668 (90)
Living area fraction	17.3905	17.7818	18.3817	19.1134	19.6696	19.9654	20.0464	20.0334	19.8168	19.0628	18.0893	17.3236 (91)
MIT	17.3905	17.7818	18.3817	19.1134	19.6696	19.9654	20.0464	20.0334	19.8168	19.0628	18.0893	17.3236 (92)
Temperature adjustment	17.2405	17.6318	18.2317	18.9634	19.5196	19.8154	19.8964	19.8834	19.6668	18.9128	17.9393	17.1736 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9770	0.9570	0.9176	0.8352	0.7003	0.5233	0.3661	0.4217	0.6756	0.8861	0.9619	0.9812 (94)
Ext temp.	668.1197	816.6493	943.7899	1020.1748	954.9530	712.9145	474.3272	493.5224	692.6359	743.6806	665.3086	623.8976 (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	1959.6917	1924.0869	1769.3344	1503.1427	1165.8669	771.0141	487.3172	514.1560	825.6712	1239.4011	1622.0423	1948.8655 (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	960.9296	744.1981	614.2051	347.7369	156.9199	0.0000	0.0000	0.0000	0.0000	368.8161	688.8483	985.7761 (98)
Space heating per m2												4867.4300 (98)
												(98) / (4) = 39.5984 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5408.2556 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	960.9296	744.1981	614.2051	347.7369	156.9199	0.0000	0.0000	0.0000	0.0000	368.8161	688.8483	985.7761 (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)	1067.6996	826.8867	682.4501	386.3743	174.3555	0.0000	0.0000	0.0000	0.0000	409.7957	765.3870	1095.3068 (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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Efficiency of water heater (217)m	89.4424	89.3820	89.2573	88.9710	88.3727	86.7000	86.7000	86.7000	86.7000	88.9864	89.3289	86.7000 (216)
Fuel for water heating, kWh/month	210.4315	184.8212	192.5357	170.5927	166.4193	148.8175	140.3263	157.5852	158.4506	176.9894	189.6341	204.4538 (219)
Water heating fuel used												2101.0572 (219)
Annual totals kWh/year												
Space heating fuel - main system												5408.2556 (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)												455.1332 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =												-666.9130
Total delivered energy for all uses												-666.9130 (233)
												7372.5330 (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	5408.2556	0.2160	1168.1832 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2101.0572	0.2160	453.8284 (264)
Space and water heating			1622.0116 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.1332	0.5190	236.2141 (268)
Energy saving/generation technologies			
PV Unit	-666.9130	0.5190	-346.1278 (269)
Total CO2, kg/year			1551.0229 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6200 (273)

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

DER		12.6200 ZC1
Total Floor Area	TFA	122.9200
Assumed number of occupants	N	2.8739
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		13.9307 ZC2
CO2 emissions from cooking, equation (L16)		1.5292 ZC3
Total CO2 emissions		28.0799 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		28.0799 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)
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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3859 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3280 (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	0.4182	0.4100	0.4018	0.3608	0.3526	0.3116	0.3116	0.3034	0.3280	0.3526	0.3690	0.3854 (22b)
Effective ac	0.5874	0.5840	0.5807	0.5651	0.5622	0.5485	0.5485	0.5460	0.5538	0.5622	0.5681	0.5743 (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)			27.0100	1.3258	35.8087		(27)
Heat Loss Floor 1			61.4600	0.1300	7.9898		(28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.1800	23.1768		(29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898		(30)
Total net area of external elements Aum (A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.9651		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3018 (36)
Total fabric heat loss						(33) + (36) =	87.2669 (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	57.0698	56.7399	56.4166	54.8979	54.6138	53.2910	53.2910	53.0461	53.8005	54.6138	55.1886	55.7895 (38)
Heat transfer coeff	144.3367	144.0069	143.6835	142.1648	141.8807	140.5579	140.5579	140.3130	141.0674	141.8807	142.4555	143.0564 (39)
Average = Sum(39)m / 12 =												142.1635 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1742	1.1715	1.1689	1.1566	1.1543	1.1435	1.1435	1.1415	1.1476	1.1543	1.1589	1.1638 (40)
HLP (average)												1.1566 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)												Total = Sum(45)m = 1612.0273 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (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)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	46.0274	50.9589	49.3151	49.0777	45.4735	46.9893	49.0777	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180 (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	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180 (64)
Heat gains from water heating, kWh/month	68.3114	60.1102	62.8940	56.0545	54.2253	47.5731	45.2963	50.7674	51.2865	58.1412	61.8880	66.5579 (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	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	91.8164	89.4496	84.5349	77.8534	72.8834	66.0737	60.8821	68.2357	71.2313	78.1468	85.9556	89.4595 (72)
Total internal gains	475.6641	473.4145	456.6689	429.3785	400.5439	373.0082	355.7829	363.0194	377.8458	405.3702	437.0437	461.2736 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					11.6600	11.2829	0.6300	0.7000	0.7700		40.2062 (75)	
Southeast					2.8400	36.7938	0.6300	0.7000	0.7700		31.9349 (77)	
Southwest					10.0500	36.7938	0.6300	0.7000	0.7700		113.0090 (79)	
Northwest					2.4600	11.2829	0.6300	0.7000	0.7700		8.4826 (81)	
Solar gains	193.6326	346.0004	516.3698	711.8095	863.0064	885.6738	841.8538	724.6346	583.3547	393.9865	234.8724	163.8034 (83)
Total gains	669.2968	819.4149	973.0387	1141.1881	1263.5503	1258.6820	1197.6366	1087.6540	961.2006	799.3567	671.9161	625.0770 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	59.1403	59.2757	59.4091	60.0438	60.1640	60.7302	60.7302	60.8362	60.5109	60.1640	59.9212	59.6695
alpha	4.9427	4.9517	4.9606	5.0029	5.0109	5.0487	5.0487	5.0557	5.0341	5.0109	4.9947	4.9780
util living area	0.9987	0.9962	0.9877	0.9528	0.8512	0.6716	0.5073	0.5754	0.8395	0.9782	0.9970	0.9991 (86)
MIT	19.6749	19.8568	20.1454	20.5170	20.8137	20.9586	20.9917	20.9850	20.8728	20.4705	20.0006	19.6443 (87)
Th 2	19.9407	19.9428	19.9449	19.9549	19.9568	19.9655	19.9655	19.9671	19.9621	19.9568	19.9530	19.9491 (88)
util rest of house	0.9983	0.9949	0.9832	0.9353	0.8006	0.5802	0.3928	0.4552	0.7659	0.9671	0.9958	0.9988 (89)
MIT 2	18.1699	18.4369	18.8575	19.3913	19.7780	19.9388	19.9625	19.9610	19.8605	19.3368	18.6549	18.1310 (90)
Living area fraction	18.3829	18.6379	19.0398	19.5506	19.9246	20.0831	20.1082	20.1060	20.0038	19.4973	18.8454	18.3453 (92)
MIT	18.3829	18.6379	19.0398	19.5506	19.9246	20.0831	20.1082	20.1060	20.0038	19.4973	18.8454	18.3453 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3829	18.6379	19.0398	19.5506	19.9246	20.0831	20.1082	20.1060	20.0038	19.4973	18.8454	18.3453 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9972	0.9925	0.9778	0.9267	0.7988	0.5913	0.4090	0.4720	0.7693	0.9603	0.9937	0.9980 (94)
Useful gains	667.4426	813.2767	951.4250	1057.5717	1009.3303	744.2238	489.8034	513.4182	739.4707	767.6197	667.6789	623.8291 (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	2032.6835	1978.3499	1801.7594	1514.1443	1166.9111	770.6954	493.1060	519.9992	832.8302	1262.3484	1673.1904	2023.5696 (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	1015.7392	782.9292	632.6488	328.7323	117.2401	0.0000	0.0000	0.0000	0.0000	368.0782	723.9683	1041.4069 (98)
Space heating												5010.7430 (98)
Space heating per m2												40.7643 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5364.8212 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1015.7392	782.9292	632.6488	328.7323	117.2401	0.0000	0.0000	0.0000	0.0000	368.0782	723.9683	1041.4069 (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)	1087.5152	838.2539	677.3542	351.9617	125.5248	0.0000	0.0000	0.0000	0.0000	394.0880	775.1266	1114.9967 (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	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180 (64)
Efficiency of water heater (217)m	88.4339	88.2131	87.7314	86.5375	84.0646	80.3000	80.3000	80.3000	80.3000	86.7189	88.0190	80.3000 (216)
Fuel for water heating, kWh/month	246.6155	217.8847	230.0188	208.9510	208.4834	192.2289	184.1700	205.3064	207.3240	216.2214	225.3667	240.4425 (219)
Water heating fuel used												2583.0134 (219)
Annual totals kWh/year												
Space heating fuel - main system												5364.8212 (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)												455.1332 (232)
Total delivered energy for all uses												8477.9678 (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	5364.8212	0.2160	1158.8014 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2583.0134	0.2160	557.9309 (264)
Space and water heating			1716.7323 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.1332	0.5190	236.2141 (268)
Total CO2, kg/m2/year			1991.8714 (272)
Emissions per m2 for space and water heating			13.9663 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9217 (272b)
Emissions per m2 for pumps and fans			0.3167 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9663 * 1.00) + 1.9217 + 0.3167, rounded to 2 d.p.			16.2000 (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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.3769 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3203 (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	0.4084	0.4004	0.3924	0.3524	0.3444	0.3043	0.3043	0.2963	0.3203	0.3444	0.3604	0.3764 (22b)
Effective ac	0.5834	0.5802	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708 (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)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			9.0000	553.1400 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17332.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 141.0093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9388 (36)
Total fabric heat loss (33) + (36) = 94.7609 (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	56.6782	56.3635	56.0551	54.6064	54.3354	53.0736	53.0736	52.8399	53.5596	54.3354	54.8837	55.4569 (38)
Heat transfer coeff	151.4391	151.1244	150.8160	149.3673	149.0963	147.8345	147.8345	147.6009	148.3205	149.0963	149.6446	150.2178 (39)
Average = Sum(39)m / 12 =												149.3660 (39)
HLP	1.2320	1.2295	1.2269	1.2152	1.2130	1.2027	1.2027	1.2008	1.2066	1.2130	1.2174	1.2221 (40)
HLP (average)												1.2151 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.5157	31.0623	32.0535	27.9450	26.8139	23.1383	21.4411	24.6040	24.8978	29.0160	31.6732	34.3951 (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	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	(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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	(71)
Water heating gains (Table 5)	47.7362	46.2236	43.0826	38.8125	36.0402	32.1366	28.8187	33.0698	34.5803	39.0000	43.9906	46.2299	(72)
Total internal gains	428.5840	427.1885	412.2166	387.3376	360.7006	336.0711	320.7194	324.8535	338.1949	363.2234	392.0787	415.0440	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					11.6600	11.2829	0.7100	0.7000	0.7700		45.3117 (75)	
Southeast					2.8400	36.7938	0.7100	0.7000	0.7700		35.9901 (77)	
Southwest					4.2500	36.7938	0.7100	0.7000	0.7700		53.8584 (79)	
Northwest					2.4600	11.2829	0.7100	0.7000	0.7700		9.5598 (81)	
Southwest					5.8000	36.7938	0.7100	0.7000	0.7700		73.5009 (79)	
Solar gains	218.2209	389.9370	581.9405	802.1980	972.5945	998.1403	948.7558	816.6517	657.4315	444.0165	264.6975	184.6039 (83)
Total gains	646.8049	817.1255	994.1571	1189.5356	1333.2951	1334.2114	1269.4752	1141.5052	995.6264	807.2399	656.7762	599.6479 (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	31.7929	31.8591	31.9242	32.2338	32.2924	32.5681	32.5681	32.6196	32.4613	32.2924	32.1741	32.0513	
alpha	3.1195	3.1239	3.1283	3.1489	3.1528	3.1712	3.1712	3.1746	3.1641	3.1528	3.1449	3.1368	
util living area	0.9894	0.9778	0.9518	0.8888	0.7739	0.6181	0.4805	0.5425	0.7702	0.9344	0.9816	0.9916	(86)
MIT	18.8467	19.1360	19.5840	20.1411	20.5935	20.8604	20.9534	20.9314	20.7055	20.0876	19.3574	18.7952	(87)
Th 2	19.8945	19.8965	19.8985	19.9079	19.9097	19.9178	19.9178	19.9194	19.9147	19.9097	19.9061	19.9024	(88)
util rest of house	0.9872	0.9732	0.9416	0.8650	0.7258	0.5384	0.3745	0.4339	0.7028	0.9153	0.9771	0.9898	(89)
MIT 2	17.9304	18.2185	18.6605	19.2033	19.6160	19.8399	19.9006	19.8916	19.7279	19.1659	18.4474	17.8848	(90)
Living area fraction	18.0601	18.3483	18.7913	19.3360	19.7543	19.9844	20.0496	20.0388	19.8663	19.2963	18.5762	18.0137	(91)
Temperature adjustment	18.0601	18.3483	18.7913	19.3360	19.7543	19.9844	20.0496	20.0388	19.8663	19.2963	18.5762	18.0137	(92)
adjusted MIT	18.0601	18.3483	18.7913	19.3360	19.7543	19.9844	20.0496	20.0388	19.8663	19.2963	18.5762	18.0137	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	635.1123	788.0840	923.0827	1011.1472	957.4697	725.3933	492.6653	509.9556	696.2733	727.7447	636.6654	590.9139	(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	2083.8129	2032.3741	1853.7184	1558.8037	1200.8728	795.9980	509.9710	537.0885	855.2606	1296.5911	1717.3515	2075.0589	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1077.8332	836.1629	692.3930	394.3127	181.0919	0.0000	0.0000	0.0000	0.0000	423.2217	778.0940	1104.2039	(98)
Space heating												5487.3132	(98)
Space heating per m2												44.6413	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1389.6446	1093.9756	1121.7667	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8259	0.8804	0.8475	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1147.7720	963.1649	950.6895	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1675.3139	1597.0347	1449.6066	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	379.8302	471.5991	371.1943	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			1222.6237 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	94.9575	117.8998	92.7986	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												305.6559 (107)
Energy for space heating												2.4866 (108)
Energy for space cooling												44.6413 (99)
Total												2.4866 (108)
Dwelling Fabric Energy Efficiency (DFEE)												47.1280 (109)
												47.1 (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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.1359 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3859 (18)					
Number of sides sheltered							2 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3280 (21)				
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4182	0.4100	0.4018	0.3608	0.3526	0.3116	0.3116	0.3034	0.3280	0.3526	0.3690	0.3854 (22b)
Effective ac	0.5874	0.5840	0.5807	0.5651	0.5622	0.5485	0.5485	0.5460	0.5538	0.5622	0.5681	0.5743 (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)			27.0100	1.3258	35.8087		(27)					
Heat Loss Floor 1			61.4600	0.1300	7.9898		(28a)					
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.1800	23.1768		(29a)					
External Roof 1	61.4600		61.4600	0.1300	7.9898		(30)					
Total net area of external elements Aum(A, m2)			278.6900				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.9651		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3018 (36)					
Total fabric heat loss						(33) + (36) =	87.2669 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 57.0698	Feb 56.7399	Mar 56.4166	Apr 54.8979	May 54.6138	Jun 53.2910	Jul 53.2910	Aug 53.0461	Sep 53.8005	Oct 54.6138	Nov 55.1886	Dec 55.7895 (38)
Heat transfer coeff	144.3367	144.0069	143.6835	142.1648	141.8807	140.5579	140.5579	140.3130	141.0674	141.8807	142.4555	143.0564 (39)
Average = Sum(39)m / 12 =												142.1635 (39)
HLP	Jan 1.1742	Feb 1.1715	Mar 1.1689	Apr 1.1566	May 1.1543	Jun 1.1435	Jul 1.1435	Aug 1.1415	Sep 1.1476	Oct 1.1543	Nov 1.1589	Dec 1.1638 (40)
HLP (average)												1.1566 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
Daily hot water use	Jan 112.7013	Feb 108.6031	Mar 104.5048	Apr 100.4066	May 96.3084	Jun 92.2101	Jul 92.2101	Aug 96.3084	Sep 100.4066	Oct 104.5048	Nov 108.6031	Dec 112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)												Total = Sum(45)m = 1612.0273 (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)

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	(59)
Heat gains from water heating, kWh/month	35.5157	31.0623	32.0535	27.9450	26.8139	23.1383	21.4411	24.6040	24.8978	29.0160	31.6732	34.3951 (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	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	(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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	(71)
Water heating gains (Table 5)	47.7362	46.2236	43.0826	38.8125	36.0402	32.1366	28.8187	33.0698	34.5803	39.0000	43.9906	46.2299	(72)
Total internal gains	428.5840	427.1885	412.2166	387.3376	360.7006	336.0711	320.7194	324.8535	338.1949	363.2234	392.0787	415.0440	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					11.6600	11.2829	0.6300	0.7000	0.7700		40.2062 (75)	
Southeast					2.8400	36.7938	0.6300	0.7000	0.7700		31.9349 (77)	
Southwest					10.0500	36.7938	0.6300	0.7000	0.7700		113.0090 (79)	
Northwest					2.4600	11.2829	0.6300	0.7000	0.7700		8.4826 (81)	
Solar gains	193.6326	346.0004	516.3698	711.8095	863.0064	885.6738	841.8538	724.6346	583.3547	393.9865	234.8724	163.8034 (83)
Total gains	622.2166	773.1889	928.5864	1099.1471	1223.7070	1221.7449	1162.5732	1049.4881	921.5496	757.2099	626.9511	578.8474 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.1403	59.2757	59.4091	60.0438	60.1640	60.7302	60.7302	60.8362	60.5109	60.1640	59.9212	59.6695	
alpha	4.9427	4.9517	4.9606	5.0029	5.0109	5.0487	5.0487	5.0557	5.0341	5.0109	4.9947	4.9780	
util living area	0.9991	0.9971	0.9899	0.9588	0.8634	0.6872	0.5215	0.5936	0.8562	0.9825	0.9978	0.9994	(86)
MIT	19.6393	19.8222	20.1135	20.4915	20.7993	20.9541	20.9906	20.9828	20.8591	20.4414	19.9667	19.6092	(87)
Th 2	19.9407	19.9428	19.9449	19.9549	19.9568	19.9655	19.9655	19.9671	19.9621	19.9568	19.9530	19.9491	(88)
util rest of house	0.9988	0.9961	0.9861	0.9431	0.8149	0.5954	0.4043	0.4709	0.7861	0.9733	0.9969	0.9991	(89)
MIT 2	18.6961	18.8803	19.1712	19.5466	19.8238	19.9450	19.9632	19.9623	19.8837	19.5059	19.0331	18.6728	(90)
Living area fraction									fLA = Living area / (4) =			0.1416	(91)
MIT	18.8296	19.0136	19.3046	19.6804	19.9618	20.0879	20.1086	20.1068	20.0218	19.6383	19.1652	18.8053	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8296	19.0136	19.3046	19.6804	19.9618	20.0879	20.1086	20.1068	20.0218	19.6383	19.1652	18.8053	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	621.1371	769.1770	912.8446	1030.9529	997.5785	741.6278	489.4019	512.4548	728.7644	734.1047	624.3594	578.1445	(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	2097.1608	2032.4610	1839.8141	1532.5901	1172.1962	771.3651	493.1639	520.1052	835.3727	1282.3671	1718.7595	2089.3857	(97)
Month fracti	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 kWh	1098.1616	848.9268	689.6653	361.1788	129.9156	0.0000	0.0000	0.0000	0.0000	407.9073	787.9681	1124.3634	(98)
Space heating												5448.0868	(98)
Space heating per m2												44.3222	(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	1321.2447	1040.1288	1066.3788	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8923	0.9421	0.9145	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1178.9729	979.9147	975.2331	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1543.8595	1472.0842	1342.0542	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	262.7184	366.1741	272.9149	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												901.8074	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	65.6796	91.5435	68.2287	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												225.4519 (107)
Space cooling per m2												1.8341 (108)
Energy for space heating												44.3222 (99)
Energy for space cooling												1.8341 (108)
Total												46.1564 (109)
Target Fabric Energy Efficiency (TFEE)												53.1 (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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.3769 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3203 (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	0.3364	0.3123	0.3203	0.3043	0.3043	0.2963	0.2883	0.2803	0.2723	0.2963	0.2803	0.2963 (22b)
	0.5566	0.5488	0.5513	0.5463	0.5463	0.5439	0.5416	0.5393	0.5371	0.5439	0.5393	0.5439 (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)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (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) = 17886.0000 (34)
145.5093 (35)
8.9388 (36)
(33) + (36) = 94.7609 (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	54.0705	53.3135	53.5596	53.0736	53.0736	52.8399	52.6125	52.3913	52.1764	52.8399	52.3913	52.8399 (38)
Heat transfer coeff	148.8315	148.0744	148.3205	147.8345	147.8345	147.6009	147.3735	147.1523	146.9373	147.6009	147.1523	147.6009 (39)
Average = Sum(39)m / 12 =												147.6928 (39)
HLP	1.2108	1.2046	1.2066	1.2027	1.2027	1.2008	1.1989	1.1971	1.1954	1.2008	1.1971	1.2008 (40)
HLP (average)												1.2015 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (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	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
												1859 (64)
												1858.6152 (64)
												1859 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast						11.6600	14.6176	0.7100	0.7000			0.7700			58.7037 (75)		
Southeast						2.8400	45.1778	0.7100	0.7000			0.7700			44.1909 (77)		
Southwest						4.2500	45.1778	0.7100	0.7000			0.7700			66.1308 (79)		
Northwest						2.4600	14.6176	0.7100	0.7000			0.7700			12.3852 (81)		
Southwest						5.8000	45.1778	0.7100	0.7000			0.7700			90.2491 (79)		
Solar gains						271.6598	414.6651	627.8861	876.6733	1013.6742	1131.0133	1066.2896	938.3852	751.3373	510.5944	328.7616	225.7133 (83)
Total gains						964.7563	1102.6591	1288.9849	1495.7533	1589.1919	1667.8100	1580.6400	1462.1424	1299.4363	1100.9468	966.1519	899.2062 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.3823	33.5529	33.4973	33.6074	33.6074	33.6606	33.7125	33.7632	33.8126	33.6606	33.7632	33.6606
alpha	3.2255	3.2369	3.2332	3.2405	3.2405	3.2440	3.2475	3.2509	3.2542	3.2440	3.2509	3.2440
util living area	0.9675	0.9509	0.9064	0.8106	0.6681	0.4757	0.3548	0.3809	0.6234	0.8504	0.9442	0.9725 (86)
MIT	19.3581	19.5650	19.9795	20.4514	20.7808	20.9461	20.9844	20.9809	20.8697	20.4589	19.8560	19.3262 (87)
Th 2	19.9114	19.9163	19.9147	19.9178	19.9178	19.9194	19.9208	19.9223	19.9237	19.9194	19.9223	19.9194 (88)
util rest of house	0.9610	0.9413	0.8882	0.7752	0.6090	0.3952	0.2605	0.2806	0.5419	0.8124	0.9312	0.9669 (89)
MIT 2	17.7625	18.0615	18.6464	19.2908	19.7055	19.8820	19.9142	19.9141	19.8190	19.3209	18.4877	17.7225 (90)
Living area fraction	17.9884	18.2743	18.8351	19.4551	19.8577	20.0327	20.0657	20.0651	19.9678	19.4820	18.6814	0.1416 (91)
MIT	17.9884	18.2743	18.8351	19.4551	19.8577	20.0327	20.0657	20.0651	19.9678	19.4820	18.6814	17.9495 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8384	18.1243	18.6851	19.3051	19.7077	19.8827	19.9157	19.9151	19.8178	19.3320	18.5314	17.7995 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9432	0.9198	0.8623	0.7520	0.5964	0.3924	0.2600	0.2799	0.5331	0.7873	0.9084	0.9507 (94)
Ext temp.	910.0008	1014.2293	1111.4680	1124.8766	947.7991	654.4065	410.9702	409.2998	692.7805	866.7907	877.6244	854.9196 (95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Month fracti	1925.6412	1898.9533	1733.1357	1449.5295	1065.5498	676.4039	414.9605	414.2430	751.9904	1170.7727	1564.4313	1889.2147 (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	755.6364	594.5345	462.5207	233.7501	87.6065	0.0000	0.0000	0.0000	0.0000	226.1626	494.5009	769.5155 (98)
RHI space heating demand												3624.2273 (98)
												3624 (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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.3769 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3203 (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	0.4084	0.4004	0.3924	0.3524	0.3444	0.3043	0.3043	0.2963	0.3203	0.3444	0.3604	0.3764 (22b)
Effective ac	0.5834	0.5802	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708 (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)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.5093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9388 (36)
Total fabric heat loss (33) + (36) = 94.7609 (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	56.6782	56.3635	56.0551	54.6064	54.3354	53.0736	53.0736	52.8399	53.5596	54.3354	54.8837	55.4569 (38)
Heat transfer coeff	151.4391	151.1244	150.8160	149.3673	149.0963	147.8345	147.8345	147.6009	148.3205	149.0963	149.6446	150.2178 (39)
Average = Sum(39)m / 12 =												149.3660 (39)
HLP	1.2320	1.2295	1.2269	1.2152	1.2130	1.2027	1.2027	1.2008	1.2066	1.2130	1.2174	1.2221 (40)
HLP (average)												1.2151 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (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	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1858.6152 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					11.6600	11.2829	0.7100	0.7000			0.7700	45.3117 (75)
Southeast					2.8400	36.7938	0.7100	0.7000			0.7700	35.9901 (77)
Southwest					4.2500	36.7938	0.7100	0.7000			0.7700	53.8584 (79)
Northwest					2.4600	11.2829	0.7100	0.7000			0.7700	9.5598 (81)
Southwest					5.8000	36.7938	0.7100	0.7000			0.7700	73.5009 (79)
Solar gains	218.2209	389.9370	581.9405	802.1980	972.5945	998.1403	948.7558	816.6517	657.4315	444.0165	264.6975	184.6039 (83)
Total gains	911.3175	1077.9309	1243.0393	1421.2781	1548.1122	1534.9369	1463.1062	1340.4088	1205.5305	1034.3690	902.0878	858.0968 (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	32.8075	32.8758	32.9430	33.2625	33.3230	33.6074	33.6074	33.6606	33.4973	33.3230	33.2009	33.0742
alpha	3.1872	3.1917	3.1962	3.2175	3.2215	3.2405	3.2405	3.2440	3.2332	3.2215	3.2134	3.2049
util living area	0.9749	0.9572	0.9217	0.8452	0.7195	0.5598	0.4261	0.4774	0.6979	0.8897	0.9602	0.9790 (86)
MIT	19.1689	19.4348	19.8364	20.3205	20.6941	20.9023	20.9696	20.9560	20.7954	20.2928	19.6398	19.1158 (87)
Th 2	19.8945	19.8965	19.8985	19.9079	19.9097	19.9178	19.9178	19.9194	19.9147	19.9097	19.9061	19.9024 (88)
util rest of house	0.9699	0.9488	0.9064	0.8152	0.6672	0.4818	0.3287	0.3764	0.6244	0.8611	0.9509	0.9747 (89)
MIT 2	17.4787	17.8621	18.4349	19.1105	19.5956	19.8411	19.9021	19.8947	19.7341	19.0924	18.1689	17.4071 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.7180	18.0847	18.6333	19.2818	19.7511	19.9913	20.0532	20.0449	19.8844	19.2623	18.3771	17.6489 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5680	17.9347	18.4833	19.1318	19.6011	19.8413	19.9032	19.8949	19.7344	19.1123	18.2271	17.4989 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	869.7284	1000.5019	1094.9046	1122.5294	1007.3705	730.5271	478.9534	501.2755	736.1830	863.1899	839.7015	824.5109 (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	2009.2891	1969.8647	1807.2779	1528.2893	1178.0211	774.8449	488.3337	515.8567	835.6932	1269.1565	1665.1086	1997.7379 (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	847.8332	651.4118	530.0057	292.1472	126.9640	0.0000	0.0000	0.0000	0.0000	302.0392	594.2931	872.8809 (98)
Space heating												4217.5751 (98)
Space heating per m2										(98) / (4) =		34.3115 (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												4686.1946	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	847.8332	651.4118	530.0057	292.1472	126.9640	0.0000	0.0000	0.0000	0.0000	302.0392	594.2931	872.8809	(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)	942.0369	723.7909	588.8953	324.6080	141.0711	0.0000	0.0000	0.0000	0.0000	335.5991	660.3257	969.8677	(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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187	(64)
Efficiency of water heater (217)m	89.3820	89.3123	89.1690	88.8438	88.1983	86.7000	86.7000	86.7000	86.7000	88.8411	89.2465	86.7000	(216)
Fuel for water heating, kWh/month	210.5738	184.9654	192.7263	170.8369	166.7482	148.8175	140.3263	157.5852	158.4506	177.2790	189.8092	89.4104	(217)
Water heating fuel used												204.5833	(219)
Annual totals kWh/year												2102.7017	(219)
Space heating fuel - main system												4686.1946	(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)												455.1332	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												6652.1166	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4686.1946	3.4800	163.0796	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2102.7017	3.4800	73.1740	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	455.1332	13.1900	60.0321	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-666.9130	13.1900	-87.9658	(252)
Total energy cost			338.2123	(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] =	0.8459 (257)
SAP value	88.1992	
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	4686.1946	0.2160	1012.2180	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2102.7017	0.2160	454.1836	(264)
Space and water heating			1466.4016	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	455.1332	0.5190	236.2141	(268)
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278	(269)
Total kg/year			1395.4129	(272)
CO2 emissions per m2			11.3500	(273)
EI value			88.8646	
EI rating			89	(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 $3.48 / 0.8827 = 3.943$, stars = 4
Water heating environmental impact $0.216 / 0.8827 = 0.2447$, 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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.3769 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3203 (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	0.3364	0.3123	0.3203	0.3043	0.3043	0.2963	0.2883	0.2803	0.2723	0.2963	0.2803	0.2963 (22b)
	0.5566	0.5488	0.5513	0.5463	0.5463	0.5439	0.5416	0.5393	0.5371	0.5439	0.5393	0.5439 (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)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (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) =	17886.0000 (34)
	145.5093 (35)
	8.9388 (36)
(33) + (36) =	94.7609 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)	
(38)m	54.0705
Heat transfer coeff	148.8315
Average = Sum(39)m / 12 =	147.6928 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2108	1.2046	1.2066	1.2027	1.2027	1.2008	1.1989	1.1971	1.1954	1.2008	1.1971	1.2008 (40)
HLP (average)												1.2015 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (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	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1858.6152 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					11.6600	14.6176	0.7100	0.7000			0.7700	58.7037 (75)
Southeast					2.8400	45.1778	0.7100	0.7000			0.7700	44.1909 (77)
Southwest					4.2500	45.1778	0.7100	0.7000			0.7700	66.1308 (79)
Northwest					2.4600	14.6176	0.7100	0.7000			0.7700	12.3852 (81)
Southwest					5.8000	45.1778	0.7100	0.7000			0.7700	90.2491 (79)
Solar gains	271.6598	414.6651	627.8861	876.6733	1013.6742	1131.0133	1066.2896	938.3852	751.3373	510.5944	328.7616	225.7133 (83)
Total gains	964.7563	1102.6591	1288.9849	1495.7533	1589.1919	1667.8100	1580.6400	1462.1424	1299.4363	1100.9468	966.1519	899.2062 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	33.3823	33.5529	33.4973	33.6074	33.6074	33.6606	33.7125	33.7632	33.8126	33.6606	33.7632	33.6606
alpha	3.2255	3.2369	3.2332	3.2405	3.2405	3.2440	3.2475	3.2509	3.2542	3.2440	3.2509	3.2440
util living area	0.9675	0.9509	0.9064	0.8106	0.6681	0.4757	0.3548	0.3809	0.6234	0.8504	0.9442	0.9725 (86)
MIT	19.3581	19.5650	19.9795	20.4514	20.7808	20.9461	20.9844	20.9809	20.8697	20.4589	19.8560	19.3262 (87)
Th 2	19.9114	19.9163	19.9147	19.9178	19.9178	19.9194	19.9208	19.9223	19.9237	19.9194	19.9223	19.9194 (88)
util rest of house	0.9610	0.9413	0.8882	0.7752	0.6090	0.3952	0.2605	0.2806	0.5419	0.8124	0.9312	0.9669 (89)
MIT 2	17.7625	18.0615	18.6464	19.2908	19.7055	19.8820	19.9142	19.9141	19.8190	19.3209	18.4877	17.7225 (90)
Living area fraction	17.9884	18.2743	18.8351	19.4551	19.8577	20.0327	20.0657	20.0651	19.9678	19.4820	18.6814	17.9495 (92)
MIT	17.9884	18.2743	18.8351	19.4551	19.8577	20.0327	20.0657	20.0651	19.9678	19.4820	18.6814	17.9495 (92)
Temperature adjustment	17.8384	18.1243	18.6851	19.3051	19.7077	19.8827	19.9157	19.9151	19.8178	19.3320	18.5314	17.7995 (93)
adjusted MIT	17.8384	18.1243	18.6851	19.3051	19.7077	19.8827	19.9157	19.9151	19.8178	19.3320	18.5314	17.7995 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	910.0008	1014.2293	1111.4680	1124.8766	947.7991	654.4065	410.9702	409.2998	692.7805	866.7907	877.6244	854.9196 (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	1925.6412	1898.9533	1733.1357	1449.5295	1065.5498	676.4039	414.9605	414.2430	751.9904	1170.7727	1564.4313	1889.2147 (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	755.6364	594.5345	462.5207	233.7501	87.6065	0.0000	0.0000	0.0000	0.0000	226.1626	494.5009	769.5155 (98)
Space heating												3624.2273 (98)
Space heating per m2												29.4844 (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													4026.9192 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	755.6364	594.5345	462.5207	233.7501	87.6065	0.0000	0.0000	0.0000	0.0000	226.1626	494.5009	769.5155	(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)	839.5960	660.5939	513.9119	259.7223	97.3406	0.0000	0.0000	0.0000	0.0000	251.2917	549.4455	855.0173	(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	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187	(64)
Efficiency of water heater (217)m	89.3220	89.2612	89.0815	88.6713	87.9032	86.7000	86.7000	86.7000	86.7000	88.6154	89.1343	86.7000	(216)
Fuel for water heating, kWh/month	210.7151	185.0712	192.9156	171.1693	167.3081	148.8175	140.3263	157.5852	158.4506	177.7305	190.0480	89.3469	(217)
Water heating fuel used												204.7287	(219)
Annual totals kWh/year												2104.8662	(219)
Space heating fuel - main system												4026.9192	(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)												455.1332	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												5912.6811	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4026.9192	3.9300	158.2579	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2104.8662	3.9300	82.7212	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Energy for lighting	455.1332	17.5600	79.9214	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	17.5600	-131.5661	(252)
Total energy cost			290.5045	(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	4026.9192	0.2160	869.8145	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2104.8662	0.2160	454.6511	(264)
Space and water heating			1324.4656	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	455.1332	0.5190	236.2141	(268)
Energy saving/generation technologies				
PV Unit	-749.2375	0.5190	-388.8543	(269)
Total kg/year			1210.7505	(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	4026.9192	1.2200	4912.8414	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2104.8662	1.2200	2567.9367	(264)
Space and water heating			7480.7781	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	455.1332	3.0700	1397.2590	(268)
Energy saving/generation technologies				
PV Unit	-749.2375	3.0700	-2300.1591	(269)
Primary energy kWh/year			6808.1280	(272)
Primary energy kWh/m2/year			55.3867	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 32	-200 kg (16.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 1.63 kg/m²	B 89	B 90
Total Savings	£32 1.63 kg/m²		
Potential energy efficiency rating:		B 89	
Potential environmental impact rating:			B 90

Fuel prices for cost data on this page from database revision number 453 TEST (27 Nov 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£93	£102	-£9
Mains gas	£329	£288	£41
Space heating	£259	£259	£0
Water heating	£83	£50	£32
Lighting	£80	£80	£0
Generated (PV)	-£132	-£132	£0
Total cost of fuels	£290	£258	£32
Total cost of uses	£290	£257	£32
Delivered energy	48 kWh/m²	40 kWh/m²	8 kWh/m²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	55 kWh/m²	46 kWh/m²	9 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.3769 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3203 (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	0.4084	0.4004	0.3924	0.3524	0.3444	0.3043	0.3043	0.2963	0.3203	0.3444	0.3604	0.3764 (22b)
Effective ac	0.5834	0.5802	0.5770	0.5621	0.5593	0.5463	0.5463	0.5439	0.5513	0.5593	0.5649	0.5708 (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)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.5093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9388 (36)
Total fabric heat loss (33) + (36) = 94.7609 (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	56.6782	56.3635	56.0551	54.6064	54.3354	53.0736	53.0736	52.8399	53.5596	54.3354	54.8837	55.4569 (38)
Heat transfer coeff	151.4391	151.1244	150.8160	149.3673	149.0963	147.8345	147.8345	147.6009	148.3205	149.0963	149.6446	150.2178 (39)
Average = Sum(39)m / 12 =												149.3660 (39)
HLP	1.2320	1.2295	1.2269	1.2152	1.2130	1.2027	1.2027	1.2008	1.2066	1.2130	1.2174	1.2221 (40)
HLP (average)												1.2151 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (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	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (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												1.1250 (H8)
Utilisation factor												0.5889 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.4557 (H14)
Volume ratio Veff/V												0.7320 (H15)
Solar storage volume factor												0.9376 (H16)
Solar input	-25.5322	-42.6060	-72.5628	-97.2485	-120.1423	-118.1190	-116.5580	-101.8373	-79.7590	-54.4660	-30.2849	-880.4822 (H17)
Solar input (sum of months) = Sum (63)m =												-880.4822 (63)
Output from w/h	162.6828	122.5909	99.2893	54.5296	26.9269	10.9058	5.1048	34.7891	57.6176	103.0305	139.1132	161.5526 (64)
Total per year (kWh/year) = Sum (64)m =												978.1330 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	(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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	(71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127	(72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
Northeast					11.6600	11.2829	0.7100	0.7000			0.7700	45.3117 (75)
Southeast					2.8400	36.7938	0.7100	0.7000			0.7700	35.9901 (77)
Southwest					4.2500	36.7938	0.7100	0.7000			0.7700	53.8584 (79)
Northwest					2.4600	11.2829	0.7100	0.7000			0.7700	9.5598 (81)
Southwest					5.8000	36.7938	0.7100	0.7000			0.7700	73.5009 (79)

Solar gains	218.2209	389.9370	581.9405	802.1980	972.5945	998.1403	948.7558	816.6517	657.4315	444.0165	264.6975	184.6039 (83)
Total gains	911.3175	1077.9309	1243.0393	1421.2781	1548.1122	1534.9369	1463.1062	1340.4088	1205.5305	1034.3690	902.0878	858.0968 (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	32.8075	32.8758	32.9430	33.2625	33.3230	33.6074	33.6074	33.6606	33.4973	33.3230	33.2009	33.0742	
alpha	3.1872	3.1917	3.1962	3.2175	3.2215	3.2405	3.2405	3.2440	3.2332	3.2215	3.2134	3.2049	
util living area	0.9749	0.9572	0.9217	0.8452	0.7195	0.5598	0.4261	0.4774	0.6979	0.8897	0.9602	0.9790 (86)	
MIT	19.1689	19.4348	19.8364	20.3205	20.6941	20.9023	20.9696	20.9560	20.7954	20.2928	19.6398	19.1158 (87)	
Th 2	19.8945	19.8965	19.8985	19.9079	19.9097	19.9178	19.9178	19.9194	19.9147	19.9097	19.9061	19.9024 (88)	
util rest of house	0.9699	0.9488	0.9064	0.8152	0.6672	0.4818	0.3287	0.3764	0.6244	0.8611	0.9509	0.9747 (89)	
MIT 2	17.4787	17.8621	18.4349	19.1105	19.5956	19.8411	19.9021	19.8947	19.7341	19.0924	18.1689	17.4071 (90)	
Living area fraction									fLA = Living area / (4) =				0.1416 (91)
MIT	17.7180	18.0847	18.6333	19.2818	19.7511	19.9913	20.0532	20.0449	19.8844	19.2623	18.3771	17.6489 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.5680	17.9347	18.4833	19.1318	19.6011	19.8413	19.9032	19.8949	19.7344	19.1123	18.2271	17.4989 (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	0.9544	0.9282	0.8808	0.7898	0.6507	0.4759	0.3274	0.3740	0.6107	0.8345	0.9308	0.9609	(94)
Useful gains	869.7284	1000.5019	1094.9046	1122.5294	1007.3705	730.5271	478.9534	501.2755	736.1830	863.1899	839.7015	824.5109	(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	2009.2891	1969.8647	1807.2779	1528.2893	1178.0211	774.8449	488.3337	515.8567	835.6932	1269.1565	1665.1086	1997.7379	(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	847.8332	651.4118	530.0057	292.1472	126.9640	0.0000	0.0000	0.0000	0.0000	302.0392	594.2931	872.8809	(98)
Space heating												4217.5751	(98)
Space heating per m2											(98) / (4) =	34.3115	(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													4686.1946 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	847.8332	651.4118	530.0057	292.1472	126.9640	0.0000	0.0000	0.0000	0.0000	302.0392	594.2931	872.8809	(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)	942.0369	723.7909	588.8953	324.6080	141.0711	0.0000	0.0000	0.0000	0.0000	335.5991	660.3257	969.8677	(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	162.6828	122.5909	99.2893	54.5296	26.9269	10.9058	5.1048	34.7891	57.6176	103.0305	139.1132	161.5526	(64)
Efficiency of water heater	89.4519	89.4607	89.4627	89.4644	89.4046	86.7000	86.7000	86.7000	86.7000	89.1370	89.3549	86.7000	(216)
(217)m	89.4519	89.4607	89.4627	89.4644	89.4046	86.7000	86.7000	86.7000	86.7000	89.1370	89.3549	89.4682	(217)
Fuel for water heating, kWh/month	181.8663	137.0333	110.9839	60.9512	30.1180	12.5788	5.8879	40.1258	66.4563	115.5867	155.6861	180.5699	(219)
Water heating fuel used												1097.8442	(219)
Annual totals kWh/year													
Space heating fuel - main system												4686.1946	(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)												455.1332	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1029 * 1.00) =										-666.9130		-666.9130	(233)
Total delivered energy for all uses												5697.2590	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4686.1946	3.4800	163.0796	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1097.8442	3.4800	38.2050	(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	455.1332	13.1900	60.0321	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-666.9130	13.1900	-87.9658	(252)
Total energy cost			309.8383	(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] =	0.7750 (257)
SAP value			89.1892
SAP rating (Section 12)			89 (258)
SAP band			B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4686.1946	0.2160	1012.2180	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1097.8442	0.2160	237.1343	(264)
Space and water heating			1249.3524	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	455.1332	0.5190	236.2141	(268)
Energy saving/generation technologies				
PV Unit	-666.9130	0.5190	-346.1278	(269)
Total kg/year			1204.3137	(272)
CO2 emissions per m2			9.8000	(273)
EI value			90.3896	
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	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (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) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.8200
Infiltration rate					0.3769 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3203 (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	0.3364	0.3123	0.3203	0.3043	0.3043	0.2963	0.2883	0.2803	0.2723	0.2963	0.2803	0.2963 (22b)
	0.5566	0.5488	0.5513	0.5463	0.5463	0.5439	0.5416	0.5393	0.5371	0.5439	0.5393	0.5439 (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)			21.2100	1.3258	28.1193		(27)
French (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Heat Loss Floor 1			61.4600	0.1600	9.8336	75.0000	4609.5000 (28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.2500	32.1900	60.0000	7725.6000 (29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898	9.0000	553.1400 (30)
Total net area of external elements Aum(A, m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	85.8221		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			18.0000	1106.2800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17886.0000 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 145.5093 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.9388 (36)
 Total fabric heat loss (33) + (36) = 94.7609 (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	54.0705	53.3135	53.5596	53.0736	53.0736	52.8399	52.6125	52.3913	52.1764	52.8399	52.3913	52.8399 (38)
Heat transfer coeff	148.8315	148.0744	148.3205	147.8345	147.8345	147.6009	147.3735	147.1523	146.9373	147.6009	147.1523	147.6009 (39)
Average = Sum(39)m / 12 =												147.6928 (39)
HLP	1.2108	1.2046	1.2066	1.2027	1.2027	1.2008	1.1989	1.1971	1.1954	1.2008	1.1971	1.2008 (40)
HLP (average)												1.2015 (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												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (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

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (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	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2591 (H8)
Utilisation factor												0.5481 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.4557 (H14)
Volume ratio Veff/V												0.7320 (H15)
Solar storage volume factor												0.9376 (H16)
Solar input												-917.1094 (H17)
Solar input	-29.9183	-42.5420	-73.1194	-98.6550	-115.8762	-123.7741	-121.1711	-108.4518	-84.9103	-58.7041	-35.3855	-24.6016 (63)
Solar input (sum of months) = Sum (63)m =												-917.1094 (63)
Output from w/h	158.2967	122.6549	98.7327	53.1230	31.1929	5.2507	0.4918	28.1746	52.4664	98.7925	134.0126	158.3172 (64)
Total per year (kWh/year) = Sum (64)m =												941.5058 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175 (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)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast				11.6600	14.6176	0.7100		0.7000	0.7700		58.7037 (75)	
Southeast				2.8400	45.1778	0.7100		0.7000	0.7700		44.1909 (77)	
Southwest				4.2500	45.1778	0.7100		0.7000	0.7700		66.1308 (79)	
Northwest				2.4600	14.6176	0.7100		0.7000	0.7700		12.3852 (81)	
Southwest				5.8000	45.1778	0.7100		0.7000	0.7700		90.2491 (79)	
Solar gains	271.6598	414.6651	627.8861	876.6733	1013.6742	1131.0133	1066.2896	938.3852	751.3373	510.5944	328.7616	225.7133 (83)
Total gains	964.7563	1102.6591	1288.9849	1495.7533	1589.1919	1667.8100	1580.6400	1462.1424	1299.4363	1100.9468	966.1519	899.2062 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	33.3823	33.5529	33.4973	33.6074	33.6074	33.6606	33.7125	33.7632	33.8126	33.6606	33.7632	33.6606
Feb	3.2255	3.2369	3.2332	3.2405	3.2405	3.2440	3.2475	3.2509	3.2542	3.2440	3.2509	3.2440
util living area	0.9675	0.9509	0.9064	0.8106	0.6681	0.4757	0.3548	0.3809	0.6234	0.8504	0.9442	0.9725 (86)
MIT	19.3581	19.5650	19.9795	20.4514	20.7808	20.9461	20.9844	20.9809	20.8697	20.4589	19.8560	19.3262 (87)
Th 2	19.9114	19.9163	19.9147	19.9178	19.9178	19.9194	19.9208	19.9223	19.9237	19.9194	19.9223	19.9194 (88)
util rest of house	0.9610	0.9413	0.8882	0.7752	0.6090	0.3952	0.2605	0.2806	0.5419	0.8124	0.9312	0.9669 (89)
MIT 2	17.7625	18.0615	18.6464	19.2908	19.7055	19.8820	19.9142	19.9141	19.8190	19.3209	18.4877	17.7225 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.9884	18.2743	18.8351	19.4551	19.8577	20.0327	20.0657	20.0651	19.9678	19.4820	18.6814	17.9495 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8384	18.1243	18.6851	19.3051	19.7077	19.8827	19.9157	19.9151	19.8178	19.3320	18.5314	17.7995 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9432	0.9198	0.8623	0.7520	0.5964	0.3924	0.2600	0.2799	0.5331	0.7873	0.9084	0.9507	(94)
Useful gains	910.0008	1014.2293	1111.4680	1124.8766	947.7991	654.4065	410.9702	409.2998	692.7805	866.7907	877.6244	854.9196	(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	1925.6412	1898.9533	1733.1357	1449.5295	1065.5498	676.4039	414.9605	414.2430	751.9904	1170.7727	1564.4313	1889.2147	(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	755.6364	594.5345	462.5207	233.7501	87.6065	0.0000	0.0000	0.0000	0.0000	226.1626	494.5009	769.5155	(98)
Space heating												3624.2273	(98)
Space heating per m2											(98) / (4) =	29.4844	(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													4026.9192 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	755.6364	594.5345	462.5207	233.7501	87.6065	0.0000	0.0000	0.0000	0.0000	226.1626	494.5009	769.5155	(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)	839.5960	660.5939	513.9119	259.7223	97.3406	0.0000	0.0000	0.0000	0.0000	251.2917	549.4455	855.0173	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	158.2967	122.6549	98.7327	53.1230	31.1929	5.2507	0.4918	28.1746	52.4664	98.7925	134.0126	158.3172	(64)
Efficiency of water heater	89.4106	89.4179	89.4014	89.3701	89.1094	86.7000	86.7000	86.7000	86.7000	88.9705	89.2755	86.7000	(216)
(217)m	89.4106	89.4179	89.4014	89.3701	89.1094	86.7000	86.7000	86.7000	86.7000	88.9705	89.2755	89.4193	(217)
Fuel for water heating, kWh/month	177.0447	137.1703	110.4375	59.4416	35.0052	6.0561	0.5672	32.4966	60.5148	111.0397	150.1113	177.0504	(219)
Water heating fuel used												1056.9356	(219)
Annual totals kWh/year													
Space heating fuel - main system												4026.9192	(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)													455.1332 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1156 * 1.00) =										-749.2375		-749.2375	(233)
Total delivered energy for all uses												4914.7505	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4026.9192	3.9300	158.2579	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1056.9356	3.9300	41.5376	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Pump for solar water heating	50.0000	17.5600	8.7800	(249)
Energy for lighting	455.1332	17.5600	79.9214	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	17.5600	-131.5661	(252)
Total energy cost			258.1008	(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	4026.9192	0.2160	869.8145	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1056.9356	0.2160	228.2981	(264)
Space and water heating			1098.1126	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	455.1332	0.5190	236.2141	(268)
Energy saving/generation technologies				

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

PV Unit	-749.2375	0.5190	-388.8543 (269)
Total kg/year			1010.3475 (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	4026.9192	1.2200	4912.8414 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1056.9356	1.2200	1289.4614 (264)
Space and water heating			6202.3028 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	455.1332	3.0700	1397.2590 (268)
Energy saving/generation technologies			
PV Unit	-749.2375	3.0700	-2300.1591 (269)
Primary energy kWh/year			5683.1527 (272)
Primary energy kWh/m2/year			46.2346 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	145.5 (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	388.60 (P1)
Transmission heat loss coefficient	94.76 (37)
Summer heat loss coefficient	483.36 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	11.6600	106.0502	0.7100	0.7000	0.9000	497.7961
South East	2.8400	127.3119	0.7100	0.7000	0.9000	145.5555
South West	4.2500	127.3119	0.7100	0.7000	0.9000	217.8207
North West	2.4600	106.0502	0.7100	0.7000	0.9000	105.0239
South West	5.8000	127.3119	0.7100	0.7000	0.9000	297.2612

total:						1263.4574
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	Jun	Jul	Aug	
Solar gains	1362	1263	1108	(P3)
Internal gains	534	511	521	
Total summer gains	1896	1775	1629	(P5)
Summer gain/loss ratio	3.92	3.67	3.37	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 145.5)	0.98	0.98	0.98	
Threshold temperature	20.30	21.95	21.65	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			