

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-147				Issued on Date	13/06/2019
Assessment Reference	As Built	Prop Type Ref	P404 - Det (Op)			
Property	51, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating		88 B	DER	12.52	TER	16.20
Environmental		89 B	% DER<TER	22.74		
CO ₂ Emissions (t/year)		1.20	DFEE	46.68	TFEE	53.08
General Requirements Compliance		Pass	% DFEE<TFEE	12.06		
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) 12.52 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.7 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: 4.19 (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: 2.46 m², No overhang
Windows facing South East: 10.05 m², No overhang
Windows facing South West: 2.84 m², No overhang
Windows facing North West: 11.66 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					4.1900
Infiltration rate					0.3454 (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) =	0.2936 (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	0.3743	0.3670	0.3596	0.3229	0.3156	0.2789	0.2789	0.2715	0.2936	0.3156	0.3303	0.3449 (22b)
Effective ac	0.5700	0.5673	0.5647	0.5521	0.5498	0.5389	0.5389	0.5369	0.5431	0.5498	0.5545	0.5595 (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	55.3802
Heat transfer coeff	150.1411
Average = Sum(39)m / 12 =	148.4001 (39)
HLP	1.2215
HLP (average)	1.2073 (40)
Days in month	31

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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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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	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	2.4600				11.2829	0.7100	0.7000	0.7700	9.5598 (75)			
Southeast	4.2500				36.7938	0.7100	0.7000	0.7700	53.8584 (77)			
Southwest	2.8400				36.7938	0.7100	0.7000	0.7700	35.9901 (79)			
Northwest	11.6600				11.2829	0.7100	0.7000	0.7700	45.3117 (81)			
Southeast	5.8000				36.7938	0.7100	0.7000	0.7700	73.5009 (77)			
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	33.0911	33.1494	33.2068	33.4791	33.5305	33.7720	33.7720	33.8171	33.6786	33.5305	33.4266	33.3187
alpha	3.2061	3.2100	3.2138	3.2319	3.2354	3.2515	3.2515	3.2545	3.2452	3.2354	3.2284	3.2212
util living area	0.9887	0.9767	0.9501	0.8855	0.7679	0.6100	0.4719	0.5323	0.7617	0.9310	0.9804	0.9910 (86)
MIT	18.9502	19.2310	19.6640	20.1978	20.6280	20.8756	20.9597	20.9403	20.7332	20.1461	19.4414	18.8965 (87)
Th 2	19.9029	19.9046	19.9063	19.9142	19.9156	19.9225	19.9225	19.9238	19.9199	19.9156	19.9127	19.9095 (88)
util rest of house	0.9863	0.9719	0.9394	0.8609	0.7189	0.5301	0.3672	0.4245	0.6928	0.9108	0.9755	0.9890 (89)
MIT 2	17.1681	17.5761	18.2000	18.9548	19.5254	19.8223	19.9011	19.8892	19.6753	18.9016	17.8901	17.0939 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.4203	17.8103	18.4073	19.1308	19.6815	19.9714	20.0509	20.0380	19.8251	19.0777	18.1097	17.3490 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2703	17.6603	18.2573	18.9808	19.5315	19.8214	19.9009	19.8880	19.6751	18.9277	17.9597	17.1990 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9771	0.9570	0.9174	0.8345	0.6990	0.5220	0.3650	0.4207	0.6745	0.8858	0.9619	0.9813 (94)
Ext temp.	668.1670	816.6452	943.5593	1019.3828	953.2194	711.1534	472.9317	492.2403	691.4973	743.4169	665.3204	623.9385 (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	1947.3803	1912.4758	1759.0967	1495.9990	1160.4143	768.1338	485.6148	512.4482	822.4444	1233.9521	1614.1179	1938.3588 (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	951.7347	736.3981	606.7598	343.1636	154.1530	0.0000	0.0000	0.0000	0.0000	364.9582	683.1342	977.9287 (98)
Space heating per m2												4818.2304 (98)
												(98) / (4) = 39.1981 (99)

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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												5353.5893 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	951.7347	736.3981	606.7598	343.1636	154.1530	0.0000	0.0000	0.0000	0.0000	364.9582	683.1342	977.9287 (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)	1057.4830	818.2202	674.1775	381.2929	171.2812	0.0000	0.0000	0.0000	0.0000	405.5091	759.0380	1086.5874 (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	89.4379	89.3767	89.2502	88.9616	88.3580	86.7000	86.7000	86.7000	86.7000	88.9790	89.3244	86.7000 (216)
Fuel for water heating, kWh/month	210.4420	184.8322	192.5509	170.6107	166.4469	148.8175	140.3263	157.5852	158.4506	177.0041	189.6436	204.4620 (219)
Water heating fuel used												2101.1720 (219)
Annual totals kWh/year												
Space heating fuel - main system												5353.5893 (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 (233)
Total delivered energy for all uses												7317.9815 (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	5353.5893	0.2160	1156.3753 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2101.1720	0.2160	453.8531 (264)
Space and water heating			1610.2284 (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			1539.2397 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.5200 (273)

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

DER		12.5200 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		27.9799 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		27.9799 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	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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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					2.4600	11.2829	0.6300	0.7000	0.7700		8.4826 (75)	
Southeast					10.0500	36.7938	0.6300	0.7000	0.7700		113.0090 (77)	
Southwest					2.8400	36.7938	0.6300	0.7000	0.7700		31.9349 (79)	
Northwest					11.6600	11.2829	0.6300	0.7000	0.7700		40.2062 (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	0.1416 (91)
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 (92)
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										(98) / (4) =		40.7643 (99)

8c. Space cooling requirement

Not applicable

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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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					4.1900
Infiltration rate					0.3454 (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) =	0.2936 (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	0.3743	0.3670	0.3596	0.3229	0.3156	0.2789	0.2789	0.2715	0.2936	0.3156	0.3303	0.3449 (22b)
Effective ac	0.5700	0.5673	0.5647	0.5521	0.5498	0.5389	0.5389	0.5369	0.5431	0.5498	0.5545	0.5595 (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)
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) = 17332.8600 (34)
141.0093 (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	55.3802	55.1159	54.8569	53.6403	53.4127	52.3530	52.3530	52.1568	52.7612	53.4127	53.8731	54.3546 (38)
Heat transfer coeff	150.1411	149.8769	149.6178	148.4012	148.1736	147.1139	147.1139	146.9177	147.5221	148.1736	148.6341	149.1155 (39)
Average = Sum(39)m / 12 =												148.4001 (39)
HLP	1.2215	1.2193	1.2172	1.2073	1.2054	1.1968	1.1968	1.1952	1.2001	1.2054	1.2092	1.2131 (40)
HLP (average)												1.2073 (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					2.4600	11.2829	0.7100	0.7000	0.7700		9.5598 (75)	
Southeast					4.2500	36.7938	0.7100	0.7000	0.7700		53.8584 (77)	
Southwest					2.8400	36.7938	0.7100	0.7000	0.7700		35.9901 (79)	
Northwest					11.6600	11.2829	0.7100	0.7000	0.7700		45.3117 (81)	
Southeast					5.8000	36.7938	0.7100	0.7000	0.7700		73.5009 (77)	
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	32.0677	32.1243	32.1799	32.4437	32.4935	32.7276	32.7276	32.7713	32.6370	32.4935	32.3929	32.2883		
alpha	3.1378	3.1416	3.1453	3.1629	3.1662	3.1818	3.1818	3.1848	3.1758	3.1662	3.1595	3.1526		
util living area	0.9894	0.9777	0.9515	0.8881	0.7724	0.6164	0.4787	0.5408	0.7689	0.9341	0.9816	0.9916	(86)	
MIT	18.8653	19.1538	19.5998	20.1517	20.6002	20.8629	20.9545	20.9327	20.7098	20.0964	19.3698	18.8110	(87)	
Th 2	19.9029	19.9046	19.9063	19.9142	19.9156	19.9225	19.9225	19.9238	19.9199	19.9156	19.9127	19.9095	(88)	
util rest of house	0.9872	0.9731	0.9413	0.8642	0.7243	0.5370	0.3735	0.4328	0.7015	0.9149	0.9771	0.9898	(89)	
MIT 2	17.9548	18.2419	18.6817	19.2181	19.6268	19.8460	19.9056	19.8966	19.7358	19.1788	18.4644	17.9056	(90)	
Living area fraction	18.0837	18.3709	18.8117	19.3503	19.7646	19.9899	20.0541	20.0432	19.8737	19.3087	18.5925	18.0338	(92)	
Temperature adjustment	18.0837	18.3709	18.8117	19.3503	19.7646	19.9899	20.0541	20.0432	19.8737	19.3087	18.5925	18.0338	(93)	
adjusted MIT	18.0837	18.3709	18.8117	19.3503	19.7646	19.9899	20.0541	20.0432	19.8737	19.3087	18.5925	18.0338	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	635.1458	788.0707	922.8556	1010.3727	955.7651	723.6419	491.2306	508.6567	695.1736	727.4994	636.6710	590.9432	(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	2069.5002	2018.9833	1842.0464	1550.8325	1194.9586	792.9359	508.1453	535.2557	851.7443	1290.4001	1708.1827	2062.8322	(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	1067.1597	827.1733	683.8779	389.1310	177.9600	0.0000	0.0000	0.0000	0.0000	418.7981	771.4885	1095.0854	(98)
Space heating												5430.6738	(98)
Space heating per m2												44.1806	(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	1382.8710	1088.6431	1116.5746	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8281	0.8822	0.8495	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1145.2148	960.4452	948.4800	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	381.6714	473.6226	372.8382	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												1228.1321 (104)
Intermittency factor (Table 10b)									fC = cooled area / (4) =			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	95.4178	118.4056	93.2096	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												307.0330 (107)
Energy for space heating												2.4978 (108)
Energy for space cooling												44.1806 (99)
Total												2.4978 (108)
Dwelling Fabric Energy Efficiency (DFEE)												46.6784 (109)
												46.7 (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	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					2.4600	11.2829	0.6300	0.7000	0.7700	8.4826 (75)				
Southeast					10.0500	36.7938	0.6300	0.7000	0.7700	113.0090 (77)				
Southwest					2.8400	36.7938	0.6300	0.7000	0.7700	31.9349 (79)				
Northwest					11.6600	11.2829	0.6300	0.7000	0.7700	40.2062 (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					4.1900
Infiltration rate					0.3454 (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) =	0.2936 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3082	0.2862	0.2936	0.2789	0.2789	0.2715	0.2642	0.2569	0.2495	0.2715	0.2569	0.2715 (22b)
Effective ac	0.5475	0.5410	0.5431	0.5389	0.5389	0.5369	0.5349	0.5330	0.5311	0.5369	0.5330	0.5369 (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	53.1903	52.5545	52.7612	52.3530	52.3530	52.1568	51.9658	51.7800	51.5995	52.1568	51.7800	52.1568 (38)
Heat transfer coeff	147.9512	147.3154	147.5221	147.1139	147.1139	146.9177	146.7267	146.5409	146.3604	146.9177	146.5409	146.9177 (39)
Average = Sum(39)m / 12 =												146.9949 (39)
HLP	1.2036	1.1985	1.2001	1.1968	1.1968	1.1952	1.1937	1.1922	1.1907	1.1952	1.1922	1.1952 (40)
HLP (average)												1.1959 (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	2.4600				14.6176		0.7100		0.7000		0.7700		12.3852 (75)	
Southeast	4.2500				45.1778		0.7100		0.7000		0.7700		66.1308 (77)	
Southwest	2.8400				45.1778		0.7100		0.7000		0.7700		44.1909 (79)	
Northwest	11.6600				14.6176		0.7100		0.7000		0.7700		58.7037 (81)	
Southeast	5.8000				45.1778		0.7100		0.7000		0.7700		90.2491 (77)	
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	33.5809	33.7258	33.6786	33.7720	33.7720	33.8171	33.8611	33.9041	33.9459	33.8171	33.9041	33.8171
alpha	3.2387	3.2484	3.2452	3.2515	3.2515	3.2545	3.2574	3.2603	3.2631	3.2545	3.2603	3.2545
util living area	0.9674	0.9507	0.9059	0.8095	0.6665	0.4741	0.3535	0.3795	0.6220	0.8496	0.9440	0.9725 (86)
MIT	19.3707	19.5758	19.9895	20.4581	20.7845	20.9473	20.9848	20.9813	20.8716	20.4645	19.8633	19.3360 (87)
Th 2	19.9171	19.9212	19.9199	19.9225	19.9225	19.9238	19.9251	19.9263	19.9275	19.9238	19.9263	19.9238 (88)
util rest of house	0.9609	0.9411	0.8877	0.7742	0.6075	0.3940	0.2598	0.2799	0.5408	0.8116	0.9310	0.9668 (89)
MIT 2	17.7843	18.0801	18.6639	19.3032	19.7138	19.8873	19.9186	19.9182	19.8243	19.3316	18.5006	17.7393 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	18.0089	18.2918	18.8516	19.4667	19.8653	20.0373	20.0695	20.0687	19.9726	19.4919	18.6935	17.9653 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8589	18.1418	18.7016	19.3167	19.7153	19.8873	19.9195	19.9187	19.8226	19.3419	18.5435	17.8153 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	909.9416	1014.0661	1110.9198	1123.6008	945.7684	652.4597	409.8064	408.2235	691.4376	866.0842	877.4761	854.8960 (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	1917.2834	1891.7941	1726.2393	1444.1669	1061.4743	673.9590	413.6973	413.0540	749.7418	1166.8117	1559.7069	1882.7944 (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	749.4623	589.8332	457.7977	230.8076	86.0852	0.0000	0.0000	0.0000	0.0000	223.7412	491.2062	764.7564 (98)
Space heating												3593.6899 (98)
RHI space heating demand												3594 (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					4.1900
Infiltration rate					0.3454 (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) =	0.2936 (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	0.3743	0.3670	0.3596	0.3229	0.3156	0.2789	0.2789	0.2715	0.2936	0.3156	0.3303	0.3449 (22b)
Effective ac	0.5700	0.5673	0.5647	0.5521	0.5498	0.5389	0.5389	0.5369	0.5431	0.5498	0.5545	0.5595 (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	55.3802	55.1159	54.8569	53.6403	53.4127	52.3530	52.3530	52.1568	52.7612	53.4127	53.8731	54.3546 (38)
Heat transfer coeff	150.1411	149.8769	149.6178	148.4012	148.1736	147.1139	147.1139	146.9177	147.5221	148.1736	148.6341	149.1155 (39)
Average = Sum(39)m / 12 =												148.4001 (39)
HLP	1.2215	1.2193	1.2172	1.2073	1.2054	1.1968	1.1968	1.1952	1.2001	1.2054	1.2092	1.2131 (40)
HLP (average)												1.2073 (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					2.4600	11.2829	0.7100	0.7000	0.7700		9.5598 (75)					
Southeast					4.2500	36.7938	0.7100	0.7000	0.7700		53.8584 (77)					
Southwest					2.8400	36.7938	0.7100	0.7000	0.7700		35.9901 (79)					
Northwest					11.6600	11.2829	0.7100	0.7000	0.7700		45.3117 (81)					
Southeast					5.8000	36.7938	0.7100	0.7000	0.7700		73.5009 (77)					
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	33.0911	33.1494	33.2068	33.4791	33.5305	33.7720	33.7720	33.8171	33.6786	33.5305	33.4266	33.3187
alpha	3.2061	3.2100	3.2138	3.2319	3.2354	3.2515	3.2515	3.2545	3.2452	3.2354	3.2284	3.2212
util living area	0.9748	0.9569	0.9211	0.8441	0.7177	0.5581	0.4245	0.4757	0.6962	0.8890	0.9600	0.9789 (86)
MIT	19.1879	19.4527	19.8520	20.3304	20.6999	20.9043	20.9704	20.9570	20.7990	20.3014	19.6524	19.1320 (87)
Th 2	19.9029	19.9046	19.9063	19.9142	19.9156	19.9225	19.9225	19.9238	19.9199	19.9156	19.9127	19.9095 (88)
util rest of house	0.9698	0.9485	0.9057	0.8141	0.6655	0.4804	0.3277	0.3753	0.6229	0.8603	0.9507	0.9747 (89)
MIT 2	17.5113	17.8929	18.4620	19.1283	19.6076	19.8473	19.9072	19.8997	19.7425	19.1081	18.1910	17.4348 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.7486	18.1137	18.6588	19.2985	19.7622	19.9969	20.0577	20.0493	19.8920	19.2770	18.3979	17.6751 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5986	17.9637	18.5088	19.1485	19.6122	19.8469	19.9077	19.8993	19.7420	19.1270	18.2479	17.5251 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	869.7105	1000.3182	1094.3091	1121.2262	1005.0926	728.5070	477.4645	499.8606	734.6117	862.5680	839.5927	824.5174 (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	1996.6697	1957.9470	1796.7319	1520.8914	1172.3795	771.8946	486.6079	514.1150	832.3232	1263.4808	1656.9529	1986.9761 (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	838.4577	643.5265	522.6025	287.7589	124.4614	0.0000	0.0000	0.0000	0.0000	298.2791	588.4993	864.8693 (98)
Space heating												4168.4548 (98)
Space heating per m2												(98) / (4) = 33.9119 (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													4631.6164 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	838.4577	643.5265	522.6025	287.7589	124.4614	0.0000	0.0000	0.0000	0.0000	298.2791	588.4993	864.8693	(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)	931.6196	715.0295	580.6695	319.7322	138.2905	0.0000	0.0000	0.0000	0.0000	331.4212	653.8881	960.9659	(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	89.3764	89.3057	89.1602	88.8324	88.1821	86.7000	86.7000	86.7000	86.7000	88.8316	89.2408	86.7000	(216)
Fuel for water heating, kWh/month	210.5870	184.9792	192.7453	170.8588	166.7790	148.8175	140.3263	157.5852	158.4506	177.2979	189.8213	89.4059	(217)
Water heating fuel used												204.5935	(219)
Annual totals kWh/year												2102.8416	(219)
Space heating fuel - main system												4631.6164	(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												6597.6783	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4631.6164	3.4800	161.1803	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2102.8416	3.4800	73.1789	(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			336.3179	(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] =	0.8412 (257)
SAP value	88.2653	
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	4631.6164	0.2160	1000.4292	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2102.8416	0.2160	454.2138	(264)
Space and water heating			1454.6429	(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			1383.6542	(272)
CO2 emissions per m2			11.2600	(273)
EI value			88.9585	
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 $3.48 / 0.8826 = 3.943$, stars = 4
Water heating environmental impact $0.216 / 0.8826 = 0.2447$, 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					4.1900
Infiltration rate					0.3454 (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) =	0.2936 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3082	0.2862	0.2936	0.2789	0.2789	0.2715	0.2642	0.2569	0.2495	0.2715	0.2569	0.2715 (22b)
Effective ac	0.5475	0.5410	0.5431	0.5389	0.5389	0.5369	0.5349	0.5330	0.5311	0.5369	0.5330	0.5369 (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	53.1903	52.5545	52.7612	52.3530	52.3530	52.1568	51.9658	51.7800	51.5995	52.1568	51.7800	52.1568 (38)
Heat transfer coeff	147.9512	147.3154	147.5221	147.1139	147.1139	146.9177	146.7267	146.5409	146.3604	146.9177	146.5409	146.9177 (39)
Average = Sum(39)m / 12 =												146.9949 (39)
HLP	1.2036	1.1985	1.2001	1.1968	1.1968	1.1952	1.1937	1.1922	1.1907	1.1952	1.1922	1.1952 (40)
HLP (average)												1.1959 (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				2.4600	14.6176	0.7100		0.7000		0.7700		12.3852 (75)			
Southeast				4.2500	45.1778	0.7100		0.7000		0.7700		66.1308 (77)			
Southwest				2.8400	45.1778	0.7100		0.7000		0.7700		44.1909 (79)			
Northwest				11.6600	14.6176	0.7100		0.7000		0.7700		58.7037 (81)			
Southeast				5.8000	45.1778	0.7100		0.7000		0.7700		90.2491 (77)			
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	33.5809	33.7258	33.6786	33.7720	33.7720	33.8171	33.8611	33.9041	33.9459	33.8171	33.9041	33.8171
alpha	3.2387	3.2484	3.2452	3.2515	3.2515	3.2545	3.2574	3.2603	3.2631	3.2545	3.2603	3.2545
util living area	0.9674	0.9507	0.9059	0.8095	0.6665	0.4741	0.3535	0.3795	0.6220	0.8496	0.9440	0.9725 (86)
MIT	19.3707	19.5758	19.9895	20.4581	20.7845	20.9473	20.9848	20.9813	20.8716	20.4645	19.8633	19.3360 (87)
Th 2	19.9171	19.9212	19.9199	19.9225	19.9225	19.9238	19.9251	19.9263	19.9275	19.9238	19.9263	19.9238 (88)
util rest of house	0.9609	0.9411	0.8877	0.7742	0.6075	0.3940	0.2598	0.2799	0.5408	0.8116	0.9310	0.9668 (89)
MIT 2	17.7843	18.0801	18.6639	19.3032	19.7138	19.8873	19.9186	19.9182	19.8243	19.3316	18.5006	17.7393 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	18.0089	18.2918	18.8516	19.4667	19.8653	20.0373	20.0695	20.0687	19.9726	19.4919	18.6935	17.9653 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8589	18.1418	18.7016	19.3167	19.7153	19.8873	19.9195	19.9187	19.8226	19.3419	18.5435	17.8153 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	909.9416	1014.0661	1110.9198	1123.6008	945.7684	652.4597	409.8064	408.2235	691.4376	866.0842	877.4761	854.8960 (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	1917.2834	1891.7941	1726.2393	1444.1669	1061.4743	673.9590	413.6973	413.0540	749.7418	1166.8117	1559.7069	1882.7944 (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	749.4623	589.8332	457.7977	230.8076	86.0852	0.0000	0.0000	0.0000	0.0000	223.7412	491.2062	764.7564 (98)
Space heating												3593.6899 (98)
Space heating per m2										(98) / (4) =		29.2360 (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													3992.9887 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	749.4623	589.8332	457.7977	230.8076	86.0852	0.0000	0.0000	0.0000	0.0000	223.7412	491.2062	764.7564	(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)	832.7359	655.3702	508.6641	256.4529	95.6502	0.0000	0.0000	0.0000	0.0000	248.6014	545.7847	849.7293	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	188.2150	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	89.3176	89.2567	89.0747	88.6612	87.8899	86.7000	86.7000	86.7000	86.7000	88.6067	89.1301	86.7000	(216)
Fuel for water heating, kWh/month	210.7255	185.0806	192.9304	171.1888	167.3335	148.8175	140.3263	157.5852	158.4506	177.7479	190.0572	204.7362	(219)
Water heating fuel used												2104.9797	(219)
Annual totals kWh/year													
Space heating fuel - main system												3992.9887	(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												5878.8641	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3992.9887	3.9200	156.5252	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2104.9797	3.9200	82.5152	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	455.1332	16.9600	77.1906	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	16.9600	-127.0707	(252)
Total energy cost			289.8803	(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	3992.9887	0.2160	862.4856	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2104.9797	0.2160	454.6756	(264)
Space and water heating			1317.1612	(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			1203.4461	(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	3992.9887	1.2200	4871.4462	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2104.9797	1.2200	2568.0752	(264)
Space and water heating			7439.5214	(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			6766.8713	(272)
Primary energy kWh/m2/year			55.0510	(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	-£ 33	-200 kg (16.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£33 1.63 kg/m²	B 89	B 90
Total Savings	£33 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 443 TEST (28 May 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£90	£98	-£8
Mains gas	£327	£286	£41
Space heating	£257	£257	£0
Water heating	£83	£50	£33
Lighting	£77	£77	£0
Generated (PV)	-£127	-£127	£0
Total cost of fuels	£290	£257	£33
Total cost of uses	£290	£257	£33
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					4.1900
Infiltration rate					0.3454 (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) =		0.2936 (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	0.3743	0.3670	0.3596	0.3229	0.3156	0.2789	0.2789	0.2715	0.2936	0.3156	0.3303	0.3449 (22b)
Effective ac	0.5700	0.5673	0.5647	0.5521	0.5498	0.5389	0.5389	0.5369	0.5431	0.5498	0.5545	0.5595 (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	55.3802
Heat transfer coeff	150.1411
Average = Sum(39)m / 12 =	148.4001 (39)
HLP	1.2215
HLP (average)	1.2073 (40)
Days in month	31

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					2.4600	11.2829		0.7100	0.7000	0.7700		9.5598 (75)
Southeast					4.2500	36.7938		0.7100	0.7000	0.7700		53.8584 (77)
Southwest					2.8400	36.7938		0.7100	0.7000	0.7700		35.9901 (79)
Northwest					11.6600	11.2829		0.7100	0.7000	0.7700		45.3117 (81)
Southeast					5.8000	36.7938		0.7100	0.7000	0.7700		73.5009 (77)
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, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	33.0911	33.1494	33.2068	33.4791	33.5305	33.7720	33.7720	33.8171	33.6786	33.5305	33.4266	33.3187	
alpha	3.2061	3.2100	3.2138	3.2319	3.2354	3.2515	3.2515	3.2545	3.2452	3.2354	3.2284	3.2212	
util living area	0.9748	0.9569	0.9211	0.8441	0.7177	0.5581	0.4245	0.4757	0.6962	0.8890	0.9600	0.9789	(86)
MIT	19.1879	19.4527	19.8520	20.3304	20.6999	20.9043	20.9704	20.9570	20.7990	20.3014	19.6524	19.1320	(87)
Th 2	19.9029	19.9046	19.9063	19.9142	19.9156	19.9225	19.9225	19.9238	19.9199	19.9156	19.9127	19.9095	(88)
util rest of house	0.9698	0.9485	0.9057	0.8141	0.6655	0.4804	0.3277	0.3753	0.6229	0.8603	0.9507	0.9747	(89)
MIT 2	17.5113	17.8929	18.4620	19.1283	19.6076	19.8473	19.9072	19.8997	19.7425	19.1081	18.1910	17.4348	(90)
Living area fraction									fLA = Living area / (4) =			0.1416	(91)
MIT	17.7486	18.1137	18.6588	19.2985	19.7622	19.9969	20.0577	20.0493	19.8920	19.2770	18.3979	17.6751	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.5986	17.9637	18.5088	19.1485	19.6122	19.8469	19.9077	19.8993	19.7420	19.1270	18.2479	17.5251	(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	0.9543	0.9280	0.8803	0.7889	0.6492	0.4746	0.3263	0.3729	0.6094	0.8339	0.9307	0.9609	(94)
Useful gains	869.7105	1000.3182	1094.3091	1121.2262	1005.0926	728.5070	477.4645	499.8606	734.6117	862.5680	839.5927	824.5174	(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	1996.6697	1957.9470	1796.7319	1520.8914	1172.3795	771.8946	486.6079	514.1150	832.3232	1263.4808	1656.9529	1986.9761	(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	838.4577	643.5265	522.6025	287.7589	124.4614	0.0000	0.0000	0.0000	0.0000	298.2791	588.4993	864.8693	(98)
Space heating												4168.4548	(98)
Space heating per m2											(98) / (4) =	33.9119	(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													4631.6164	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	838.4577	643.5265	522.6025	287.7589	124.4614	0.0000	0.0000	0.0000	0.0000	298.2791	588.4993	864.8693	(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)	931.6196	715.0295	580.6695	319.7322	138.2905	0.0000	0.0000	0.0000	0.0000	331.4212	653.8881	960.9659	(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	89.4468	89.4552	89.4564	89.4576	89.3948	86.7000	86.7000	86.7000	86.7000	89.1290	89.3498	86.7000	(216)	
(217)m	89.4468	89.4552	89.4564	89.4576	89.3948	86.7000	86.7000	86.7000	86.7000	89.1290	89.3498	89.4640	(217)	
Fuel for water heating, kWh/month	181.8766	137.0417	110.9918	60.9558	30.1213	12.5788	5.8879	40.1258	66.4563	115.5970	155.6950	180.5783	(219)	
Water heating fuel used												1097.9064	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4631.6164	(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												5642.7431	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4631.6164	3.4800	161.1803	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1097.9064	3.4800	38.2071	(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			307.9411	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.7702	(257)
SAP value			89.2554	
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	4631.6164	0.2160	1000.4292 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1097.9064	0.2160	237.1478 (264)
Space and water heating			1237.5769 (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			1192.5382 (272)
CO2 emissions per m2			9.7000 (273)
EI value			90.4836
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					4.1900
Infiltration rate					0.3454 (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)	=	0.2936 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3082	0.2862	0.2936	0.2789	0.2789	0.2715	0.2642	0.2569	0.2495	0.2715	0.2569	0.2715 (22b)
Effective ac	0.5475	0.5410	0.5431	0.5389	0.5389	0.5369	0.5349	0.5330	0.5311	0.5369	0.5330	0.5369 (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	53.1903	52.5545	52.7612	52.3530	52.3530	52.1568	51.9658	51.7800	51.5995	52.1568	51.7800	52.1568 (38)
Heat transfer coeff	147.9512	147.3154	147.5221	147.1139	147.1139	146.9177	146.7267	146.5409	146.3604	146.9177	146.5409	146.9177 (39)
Average = Sum(39)m / 12 =												146.9949 (39)
HLP	1.2036	1.1985	1.2001	1.1968	1.1968	1.1952	1.1937	1.1922	1.1907	1.1952	1.1922	1.1952 (40)
HLP (average)												1.1959 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.8739 (42)
Assumed occupancy												
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				2.4600	14.6176		0.7100	0.7000		0.7700		12.3852 (75)			
Southeast				4.2500	45.1778		0.7100	0.7000		0.7700		66.1308 (77)			
Southwest				2.8400	45.1778		0.7100	0.7000		0.7700		44.1909 (79)			
Northwest				11.6600	14.6176		0.7100	0.7000		0.7700		58.7037 (81)			
Southeast				5.8000	45.1778		0.7100	0.7000		0.7700		90.2491 (77)			
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	33.5809	33.7258	33.6786	33.7720	33.7720	33.8171	33.8611	33.9041	33.9459	33.8171	33.9041	33.8171
alpha	3.2387	3.2484	3.2452	3.2515	3.2515	3.2545	3.2574	3.2603	3.2631	3.2545	3.2603	3.2545
util living area	0.9674	0.9507	0.9059	0.8095	0.6665	0.4741	0.3535	0.3795	0.6220	0.8496	0.9440	0.9725 (86)
MIT	19.3707	19.5758	19.9895	20.4581	20.7845	20.9473	20.9848	20.9813	20.8716	20.4645	19.8633	19.3360 (87)
Th 2	19.9171	19.9212	19.9199	19.9225	19.9225	19.9238	19.9251	19.9263	19.9275	19.9238	19.9263	19.9238 (88)
util rest of house	0.9609	0.9411	0.8877	0.7742	0.6075	0.3940	0.2598	0.2799	0.5408	0.8116	0.9310	0.9668 (89)
MIT 2	17.7843	18.0801	18.6639	19.3032	19.7138	19.8873	19.9186	19.9182	19.8243	19.3316	18.5006	17.7393 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	18.0089	18.2918	18.8516	19.4667	19.8653	20.0373	20.0695	20.0687	19.9726	19.4919	18.6935	17.9653 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8589	18.1418	18.7016	19.3167	19.7153	19.8873	19.9195	19.9187	19.8226	19.3419	18.5435	17.8153 (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	0.9197	0.8619	0.7512	0.5951	0.3912	0.2593	0.2792	0.5321	0.7867	0.9082	0.9507	(94)
Useful gains	909.9416	1014.0661	1110.9198	1123.6008	945.7684	652.4597	409.8064	408.2235	691.4376	866.0842	877.4761	854.8960	(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	1917.2834	1891.7941	1726.2393	1444.1669	1061.4743	673.9590	413.6973	413.0540	749.7418	1166.8117	1559.7069	1882.7944	(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	749.4623	589.8332	457.7977	230.8076	86.0852	0.0000	0.0000	0.0000	0.0000	223.7412	491.2062	764.7564	(98)
Space heating												3593.6899	(98)
Space heating per m2											(98) / (4) =	29.2360	(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													3992.9887	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	749.4623	589.8332	457.7977	230.8076	86.0852	0.0000	0.0000	0.0000	0.0000	223.7412	491.2062	764.7564	(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)	832.7359	655.3702	508.6641	256.4529	95.6502	0.0000	0.0000	0.0000	0.0000	248.6014	545.7847	849.7293	(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	89.4066	89.4141	89.3963	89.3636	89.0980	86.7000	86.7000	86.7000	86.7000	88.9628	89.2717	89.4163	(216)	
Fuel for water heating, kWh/month	177.0526	137.1762	110.4438	59.4459	35.0097	6.0561	0.5672	32.4966	60.5148	111.0492	150.1177	177.0563	(219)	
Water heating fuel used												1056.9862	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3992.9887	(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													4880.8706	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3992.9887	3.9200	156.5252	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1056.9862	3.9200	41.4339	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	455.1332	16.9600	77.1906	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	16.9600	-127.0707	(252)
Total energy cost			257.2789	(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	3992.9887	0.2160	862.4856	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1056.9862	0.2160	228.3090	(264)
Space and water heating			1090.7946	(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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PV Unit	-749.2375	0.5190	-388.8543 (269)
Total kg/year			1003.0295 (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	3992.9887	1.2200	4871.4462 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1056.9862	1.2200	1289.5231 (264)
Space and water heating			6160.9694 (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			5641.8193 (272)
Primary energy kWh/m2/year			45.8983 (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 West
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	2.4600	106.0502	0.7100	0.7000	0.9000	105.0239
South East	4.2500	127.3119	0.7100	0.7000	0.9000	217.8207
South West	2.8400	127.3119	0.7100	0.7000	0.9000	145.5555
North West	11.6600	106.0502	0.7100	0.7000	0.9000	497.7961
South East	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			