

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-178				Issued on Date	03/12/2018
Assessment Reference	As Built	Prop Type Ref	P404 - Det (Op)			
Property	10, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	88 B	DER	12.92	TER	16.20	
Environmental	89 B	% DER<TER	20.27			
CO ₂ Emissions (t/year)	1.24	DFEE	48.11	TFEE	53.08	
General Requirements Compliance	Pass	% DFEE<TFEE	9.36			
Assessor	Silvio Junges, Tel: 01884 242050				Assessor ID	P637-0001
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) 12.92 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.40 (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: 4.94 (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

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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					4.9400
Infiltration rate					0.3829 (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) =		0.3254 (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	0.4149	0.4068	0.3987	0.3580	0.3498	0.3092	0.3092	0.3010	0.3254	0.3498	0.3661	0.3824 (22b)
Effective ac	0.5861	0.5827	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731 (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	0.1500	9.2190	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) =		85.2075		(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) = 94.1463 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	56.9382	56.6135	56.2951	54.8000	54.5202	53.2180	53.2180	52.9768	53.7196	54.5202	55.0861	55.6778 (38)
Heat transfer coeff	151.0846	150.7598	150.4415	148.9463	148.6666	147.3643	147.3643	147.1232	147.8659	148.6666	149.2325	149.8241 (39)
Average = Sum(39)m / 12 =												148.9450 (39)
HLP	1.2291	1.2265	1.2239	1.2117	1.2095	1.1989	1.1989	1.1969	1.2029	1.2095	1.2141	1.2189 (40)
HLP (average)												1.2117 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

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Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1858.6152 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	465.6250	463.3677	446.6062	419.2942	391.0709	364.2113	346.9705	353.5319	367.7401	395.2869	426.9856	451.2268 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					2.4600	11.2829	0.6200	0.7000	0.7700		8.3480 (75)	
Southeast					4.2500	36.7938	0.6200	0.7000	0.7700		47.0313 (77)	
Southwest					2.8400	36.7938	0.6200	0.7000	0.7700		31.4280 (79)	
Northwest					11.6600	11.2829	0.6200	0.7000	0.7700		39.5680 (81)	
Southeast					5.8000	36.7938	0.6200	0.7000	0.7700		64.1839 (77)	
Solar gains	190.5591	340.5083	508.1734	700.5110	849.3079	871.6155	828.4910	713.1324	574.0951	387.7327	231.1443	161.2034 (83)
Total gains	656.1840	803.8760	954.7796	1119.8052	1240.3788	1235.8268	1175.4615	1066.6644	941.8352	783.0196	658.1298	612.4302 (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	32.8845	32.9553	33.0250	33.3565	33.4193	33.7146	33.7146	33.7699	33.6003	33.4193	33.2926	33.1611
alpha	3.1923	3.1970	3.2017	3.2238	3.2280	3.2476	3.2476	3.2513	3.2400	3.2280	3.2195	3.2107
util living area	0.9899	0.9803	0.9588	0.9057	0.8031	0.6531	0.5127	0.5727	0.7938	0.9418	0.9829	0.9919 (86)
MIT	18.9072	19.1677	19.5839	20.1157	20.5661	20.8469	20.9485	20.9258	20.6933	20.0919	19.3991	18.8611 (87)
Th 2	19.8968	19.8989	19.9009	19.9106	19.9124	19.9209	19.9209	19.9225	19.9176	19.9124	19.9088	19.9049 (88)
util rest of house	0.9878	0.9761	0.9497	0.8842	0.7574	0.5726	0.4019	0.4608	0.7284	0.9242	0.9786	0.9901 (89)
MIT 2	17.1019	17.4814	18.0836	18.8424	19.4496	19.7948	19.8929	19.8784	19.6307	18.8256	17.8268	17.0396 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.3575	17.7201	18.2960	19.0227	19.6076	19.9437	20.0423	20.0266	19.7811	19.0049	18.0494	17.2975 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.2075	17.5701	18.1460	18.8727	19.4576	19.7937	19.8923	19.8766	19.6311	18.8549	17.8994	17.1475 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9793	0.9626	0.9293	0.8579	0.7350	0.5621	0.3987	0.4556	0.7077	0.9002	0.9661	0.9830 (94)
Ext temp.	642.5901	773.8194	887.3027	960.7155	911.6557	694.6616	468.6908	485.9678	666.5364	704.8812	635.8365	602.0059 (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	1950.1219	1910.1417	1752.0359	1485.3895	1153.2972	765.3655	485.1661	511.4936	817.8628	1227.2256	1611.6171	1939.8411 (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	972.8036	763.6086	643.3615	377.7653	179.7813	0.0000	0.0000	0.0000	0.0000	388.6242	702.5620	995.3493 (98)
Space heating per m2												5023.8558 (98)
										(98) / (4) =		40.8709 (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													5582.0621 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	972.8036	763.6086	643.3615	377.7653	179.7813	0.0000	0.0000	0.0000	0.0000	388.6242	702.5620	995.3493	(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)	1080.8929	848.4540	714.8461	419.7392	199.7570	0.0000	0.0000	0.0000	0.0000	431.8047	780.6244	1105.9437	(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	89.4481	89.3948	89.2836	89.0287	88.4846	86.7000	86.7000	86.7000	86.7000	89.0228	89.3394	86.7000	(216)
Fuel for water heating, kWh/month	210.4182	184.7946	192.4789	170.4821	166.2088	148.8175	140.3263	157.5852	158.4506	176.9171	189.6119	204.4440	(219)
Water heating fuel used												2100.5351	(219)
Annual totals kWh/year													
Space heating fuel - main system												5582.0621	(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												7545.8174	(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	5582.0621	0.2160	1205.7254	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2100.5351	0.2160	453.7156	(264)
Space and water heating			1659.4410	(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			1588.4523	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.9200	(273)

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

DER		12.9200	ZC1
Total Floor Area	TFA	122.9200	
Assumed number of occupants	N	2.8739	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.9307	ZC2
CO2 emissions from cooking, equation (L16)		1.5292	ZC3
Total CO2 emissions		28.3799	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.3799	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1359 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3859 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3280 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4182	0.4100	0.4018	0.3608	0.3526	0.3116	0.3116	0.3034	0.3280	0.3526	0.3690	0.3854 (22b)
Effective ac	0.5874	0.5840	0.5807	0.5651	0.5622	0.5485	0.5485	0.5460	0.5538	0.5622	0.5681	0.5743 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opening Type (Uw = 1.40)			27.0100	1.3258	35.8087		(27)
Heat Loss Floor 1			61.4600	0.1300	7.9898		(28a)
100mm Knauf Supafil	155.7700	27.0100	128.7600	0.1800	23.1768		(29a)
External Roof 1	61.4600		61.4600	0.1300	7.9898		(30)
Total net area of external elements Aum (m ²)			278.6900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		74.9651		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3018 (36)
Total fabric heat loss						(33) + (36) =	87.2669 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	57.0698	56.7399	56.4166	54.8979	54.6138	53.2910	53.2910	53.0461	53.8005	54.6138	55.1886	55.7895 (38)
Heat transfer coeff	144.3367	144.0069	143.6835	142.1648	141.8807	140.5579	140.5579	140.3130	141.0674	141.8807	142.4555	143.0564 (39)
Average = Sum(39)m / 12 =												142.1635 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1742	1.1715	1.1689	1.1566	1.1543	1.1435	1.1435	1.1415	1.1476	1.1543	1.1589	1.1638 (40)
HLP (average)												1.1566 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)
Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	50.9589	46.0274	50.9589	49.3151	49.0777	45.4735	46.9893	49.0777	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180 (64)
Heat gains from water heating, kWh/month	68.3114	60.1102	62.8940	56.0545	54.2253	47.5731	45.2963	50.7674	51.2865	58.1412	61.8880	66.5579 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962	143.6962 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7715	22.8900	18.6154	14.0931	10.5347	8.8939	9.6101	12.4916	16.7662	21.2886	24.8469	26.4878 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	288.9674	291.9660	284.4097	268.3232	248.0168	228.9317	216.1817	213.1832	220.7395	236.8260	257.1323	276.2174 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696	37.3696 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	91.8164	89.4496	84.5349	77.8534	72.8834	66.0737	60.8821	68.2357	71.2313	78.1468	85.9556	89.4595 (72)
Total internal gains	475.6641	473.4145	456.6689	429.3785	400.5439	373.0082	355.7829	363.0194	377.8458	405.3702	437.0437	461.2736 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast					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	18.3453 (92)
MIT	18.3829	18.6379	19.0398	19.5506	19.9246	20.0831	20.1082	20.1060	20.0038	19.4973	18.8454	18.3453 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3829	18.6379	19.0398	19.5506	19.9246	20.0831	20.1082	20.1060	20.0038	19.4973	18.8454	18.3453 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9972	0.9925	0.9778	0.9267	0.7988	0.5913	0.4090	0.4720	0.7693	0.9603	0.9937	0.9980 (94)
Useful gains	667.4426	813.2767	951.4250	1057.5717	1009.3303	744.2238	489.8034	513.4182	739.4707	767.6197	667.6789	623.8291 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	2032.6835	1978.3499	1801.7594	1514.1443	1166.9111	770.6954	493.1060	519.9992	832.8302	1262.3484	1673.1904	2023.5696 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1015.7392	782.9292	632.6488	328.7323	117.2401	0.0000	0.0000	0.0000	0.0000	368.0782	723.9683	1041.4069 (98)
Space heating												5010.7430 (98)
Space heating per m2												40.7643 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5364.8212 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1015.7392	782.9292	632.6488	328.7323	117.2401	0.0000	0.0000	0.0000	0.0000	368.0782	723.9683	1041.4069 (98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000 (210)
Space heating fuel (main heating system)	1087.5152	838.2539	677.3542	351.9617	125.5248	0.0000	0.0000	0.0000	0.0000	394.0880	775.1266	1114.9967 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	218.0917	192.2028	201.7988	180.8209	175.2607	154.3598	147.8885	164.8610	166.4812	187.5047	198.3655	212.8180 (64)
Efficiency of water heater (217)m	88.4339	88.2131	87.7314	86.5375	84.0646	80.3000	80.3000	80.3000	80.3000	86.7189	88.0190	80.3000 (216)
Fuel for water heating, kWh/month	246.6155	217.8847	230.0188	208.9510	208.4834	192.2289	184.1700	205.3064	207.3240	216.2214	225.3667	240.4425 (219)
Water heating fuel used												2583.0134 (219)
Annual totals kWh/year												
Space heating fuel - main system												5364.8212 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												75.0000 (231)
Electricity for lighting (calculated in Appendix L)												455.1332 (232)
Total delivered energy for all uses												8477.9678 (238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5364.8212	0.2160	1158.8014 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2583.0134	0.2160	557.9309 (264)
Space and water heating			1716.7323 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.1332	0.5190	236.2141 (268)
Total CO2, kg/m2/year			1991.8714 (272)
Emissions per m2 for space and water heating			13.9663 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9217 (272b)
Emissions per m2 for pumps and fans			0.3167 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.9663 * 1.00) + 1.9217 + 0.3167, rounded to 2 d.p.			16.2000 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-178	Issued on Date	03/12/2018
Assessment Reference	As Built	Prop Type Ref	P404 - Det (Op)
Property	10, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE		
SAP Rating	88 B	DER	12.92
Environmental	89 B	% DER<TER	20.27
CO ₂ Emissions (t/year)	1.24	DFEE	48.11
General Requirements Compliance	Pass	% DFEE<TFEE	9.36
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour				
Number of chimneys		0	+	0	+	0	=	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								4.9400				
Infiltration rate								0.3829	(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) =	0.3254 (21)			
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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	0.4149	0.4068	0.3987	0.3580	0.3498	0.3092	0.3092	0.3010	0.3254	0.3498	0.3661	0.3824 (22b)
Effective ac	0.5861	0.5827	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731 (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	0.1500	9.2190	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) =	85.2075		(33)
GF			24.7700			39.0000	966.0300 (32c)
GF			71.1300			9.0000	640.1700 (32c)
FF			131.0000			9.0000	1179.0000 (32c)
Internal Floor 1			61.4600			18.0000	1106.2800 (32d)
Internal Floor 1			61.4600			9.0000	553.1400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		17332.8600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							141.0093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9388 (36)
Total fabric heat loss						(33) + (36) =	94.1463 (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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

(38)m	56.9382	56.6135	56.2951	54.8000	54.5202	53.2180	53.2180	52.9768	53.7196	54.5202	55.0861	55.6778	(38)
Heat transfer coeff	151.0846	150.7598	150.4415	148.9463	148.6666	147.3643	147.3643	147.1232	147.8659	148.6666	149.2325	149.8241	(39)
Average = Sum(39)m / 12 =												148.9450	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2291	1.2265	1.2239	1.2117	1.2095	1.1989	1.1989	1.1969	1.2029	1.2095	1.2141	1.2189	(40)
Days in month												1.2117	(40)
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8739	(42)	
Average daily hot water use (litres/day)												102.4557	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013	(44)	
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591	(45)	
Energy content (annual)												Total = Sum(45)m =	1612.0273	(45)
Distribution loss (46)m = 0.15 x (45)m														
	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	0.6200	0.7000	0.7700	8.3480 (75)
Southeast	4.2500	36.7938	0.6200	0.7000	0.7700	47.0313 (77)
Southwest	2.8400	36.7938	0.6200	0.7000	0.7700	31.4280 (79)
Northwest	11.6600	11.2829	0.6200	0.7000	0.7700	39.5680 (81)
Southeast	5.8000	36.7938	0.6200	0.7000	0.7700	64.1839 (77)

Solar gains	190.5591	340.5083	508.1734	700.5110	849.3079	871.6155	828.4910	713.1324	574.0951	387.7327	231.1443	161.2034	(83)
Total gains	619.1430	767.6968	920.3900	1087.8486	1210.0085	1207.6866	1149.2104	1037.9859	912.2900	750.9561	623.2230	576.2474	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	31.8675	31.9361	32.0037	32.3250	32.3858	32.6720	32.6720	32.7255	32.5611	32.3858	32.2630	32.1356	
alpha	3.1245	3.1291	3.1336	3.1550	3.1591	3.1781	3.1781	3.1817	3.1707	3.1591	3.1509	3.1424	
util living area													
	0.9906	0.9812	0.9602	0.9081	0.8076	0.6599	0.5203	0.5821	0.8009	0.9447	0.9841	0.9925 (86)	
MIT	18.8214	19.0890	19.5176	20.0666	20.5350	20.8318	20.9420	20.9165	20.6672	20.0404	19.3265	18.7749 (87)	
Th 2	19.8968	19.8989	19.9009	19.9106	19.9124	19.9209	19.9209	19.9225	19.9176	19.9124	19.9088	19.9049 (88)	
util rest of house													
	0.9886	0.9773	0.9515	0.8873	0.7630	0.5802	0.4092	0.4703	0.7374	0.9281	0.9801	0.9909 (89)	
MIT 2	17.9069	18.1740	18.5983	19.1373	19.5710	19.8250	19.8988	19.8878	19.7023	19.1240	18.4189	17.8664 (90)	
Living area fraction									fLA = Living area / (4) =			0.1416 (91)	
MIT	18.0364	18.3035	18.7284	19.2688	19.7074	19.9675	20.0465	20.0334	19.8389	19.2537	18.5474	17.9950 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.0364	18.3035	18.7284	19.2688	19.7074	19.9675	20.0465	20.0334	19.8389	19.2537	18.5474	17.9950 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9839	0.9694	0.9395	0.8724	0.7533	0.5840	0.4229	0.4827	0.7320	0.9149	0.9731	0.9869	(94)
Useful gains	609.1525	744.2271	864.7042	949.0361	911.5382	705.2341	486.0169	501.0854	667.8293	687.0774	606.4598	568.7000	(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	2075.3526	2020.7073	1839.6632	1544.3985	1190.4383	790.9758	507.8924	534.5634	848.5815	1286.5149	1708.3206	2066.8290	(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	1090.8529	857.7947	725.3695	428.6609	207.5016	0.0000	0.0000	0.0000	0.0000	445.9815	793.3397	1114.6080	(98)
Space heating												5664.1088	(98)
Space heating per m2											(98) / (4) =	46.0796	(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	1385.2246	1090.4960	1118.1360	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7964	0.8572	0.8219	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1103.2190	934.7881	919.0007	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1527.4277	1456.4654	1328.6101	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	305.4303	388.1279	304.7494	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												998.3076	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
0.0000	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	76.3576	97.0320	76.1873	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												249.5769	(107)
Space cooling per m2												2.0304	(108)
Energy for space heating												46.0796	(99)
Energy for space cooling												2.0304	(108)
Total												48.1100	(109)
Dwelling Fabric Energy Efficiency (DFEE)												48.1	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	61.4600 (1b)	x 2.3100 (2b)	= 141.9726 (1b) - (3b)
First floor	61.4600 (1c)	x 2.4800 (2c)	= 152.4208 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	122.9200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 294.3934 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)					
Adj infilt rate	0.4182	0.4100	0.4018	0.3608	0.3526	0.3116	0.3116	0.3034	0.3280	0.3526	0.3690	0.3854 (22b)					
Effective ac	0.5874	0.5840	0.5807	0.5651	0.5622	0.5485	0.5485	0.5460	0.5538	0.5622	0.5681	0.5743 (25)					

3. Heat losses and heat loss parameter

Element	Gross 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)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	57.0698	56.7399	56.4166	54.8979	54.6138	53.2910	53.2910	53.0461	53.8005	54.6138	55.1886	55.7895	(38)
Heat transfer coeff	144.3367	144.0069	143.6835	142.1648	141.8807	140.5579	140.5579	140.3130	141.0674	141.8807	142.4555	143.0564	(39)
Average = Sum(39)m / 12 =												142.1635	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1742	1.1715	1.1689	1.1566	1.1543	1.1435	1.1435	1.1415	1.1476	1.1543	1.1589	1.1638	(40)
HLP (average)												1.1566	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8739 (42)
Average daily hot water use (litres/day)												102.4557 (43)
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)



Property Reference	4907-0015-3817-178	Issued on Date	03/12/2018
Assessment Reference	As Built	Prop Type Ref	P404 - Det (Op)
Property	10, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE		
SAP Rating	88 B	DER	12.92
Environmental	89 B	% DER<TER	20.27
CO ₂ Emissions (t/year)	1.24	DFEE	48.11
General Requirements Compliance	Pass	% DFEE<TFEE	9.36
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

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	=	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							4.9400					
Infiltration rate							0.3829	(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) =	0.3254 (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	0.3417	0.3173	0.3254	0.3092	0.3092	0.3010	0.2929	0.2848	0.2766	0.3010	0.2848	0.3010 (22b)
Effective ac	0.5584	0.5503	0.5530	0.5478	0.5478	0.5453	0.5429	0.5405	0.5383	0.5453	0.5405	0.5453 (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	0.1500	9.2190	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) =	85.2075		(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/m ² K							145.5093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9388 (36)
Total fabric heat loss						(33) + (36) =	94.1463 (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
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

(38)m	54.2469	53.4656	53.7196	53.2180	53.2180	52.9768	52.7421	52.5138	52.2919	52.9768	52.5138	52.9768	(38)
Heat transfer coeff	148.3933	147.6119	147.8659	147.3643	147.3643	147.1232	146.8884	146.6601	146.4383	147.1232	146.6601	147.1232	(39)
Average = Sum(39)m / 12 =												147.2180	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2072	1.2009	1.2029	1.1989	1.1989	1.1969	1.1950	1.1931	1.1913	1.1969	1.1931	1.1969	(40)
Days in month													(40)
	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.8739	(42)	
Average daily hot water use (litres/day)												102.4557	(43)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use														
	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013	(44)	
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591	(45)	
Energy content (annual)												Total = Sum (45)m =	1612.0273	(45)
Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789	(46)	
Water storage loss:														
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)	
If cylinder contains dedicated solar storage														
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)	
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)	
	Solar input (sum of months) = Sum (63)m =											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)	
	Total per year (kWh/year) = Sum (64)m =											1858.6152	(64)	
RHI water heating demand												1859	(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)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	0.6200	0.7000	0.7700	10.8152 (75)
Southeast	4.2500	45.1778	0.6200	0.7000	0.7700	57.7480 (77)
Southwest	2.8400	45.1778	0.6200	0.7000	0.7700	38.5893 (79)
Northwest	11.6600	14.6176	0.6200	0.7000	0.7700	51.2624 (81)
Southeast	5.8000	45.1778	0.6200	0.7000	0.7700	78.8091 (77)

Solar gains	237.2240	362.1019	548.2949	765.5457	885.1803	987.6454	931.1261	819.4350	656.0973	445.8711	287.0876	197.1017	(83)
Total gains	930.3206	1050.0959	1209.3937	1384.6257	1460.6980	1524.4421	1445.4765	1343.1921	1204.1963	1036.2236	924.4779	870.5947	(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	33.4809	33.6581	33.6003	33.7146	33.7146	33.7699	33.8239	33.8765	33.9278	33.7699	33.8765	33.7699	
alpha	3.2321	3.2439	3.2400	3.2476	3.2476	3.2513	3.2549	3.2584	3.2619	3.2513	3.2584	3.2513	
util living area	0.9705	0.9565	0.9188	0.8352	0.7028	0.5116	0.3843	0.4103	0.6554	0.8671	0.9499	0.9748	(86)
MIT	19.3301	19.5222	19.9213	20.3939	20.7456	20.9339	20.9805	20.9764	20.8496	20.4210	19.8236	19.3040	(87)
Th 2	19.9142	19.9193	19.9176	19.9209	19.9209	19.9225	19.9240	19.9255	19.9269	19.9225	19.9255	19.9225	(88)
util rest of house	0.9645	0.9479	0.9025	0.8025	0.6448	0.4276	0.2834	0.3039	0.5739	0.8318	0.9380	0.9696	(89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

MIT 2	17.7243	18.0029	18.5690	19.2208	19.6707	19.8759	19.9156	19.9152	19.8040	19.2758	18.4447	17.6925 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.9516	18.2179	18.7604	19.3869	19.8228	20.0257	20.0663	20.0654	19.9520	19.4379	18.6399	17.9206 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8016	18.0679	18.6104	19.2369	19.6728	19.8757	19.9163	19.9154	19.8020	19.2879	18.4899	17.7706 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9476	0.9275	0.8772	0.7780	0.6300	0.4238	0.2827	0.3028	0.5633	0.8061	0.9161	0.9543 (94)	
Useful gains	881.6100	973.9971	1060.8968	1077.2578	920.2204	645.9861	408.6272	406.7416	678.3649	835.3103	846.9508	830.7725 (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													
	1914.5148	1884.6983	1716.7884	1434.8645	1057.0171	673.1886	413.6835	412.9069	747.1276	1160.4933	1553.1094	1878.8530 (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													
	768.4811	611.9912	487.9834	257.4768	101.7768	0.0000	0.0000	0.0000	0.0000	241.9362	508.4342	779.7719 (98)	
Space heating													
RHI space heating demand												3757.8515 (98)	
												3758 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					4.9400
Infiltration rate					0.3829 (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) =		0.3254 (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	0.4149	0.4068	0.3987	0.3580	0.3498	0.3092	0.3092	0.3010	0.3254	0.3498	0.3661	0.3824 (22b)
Effective ac	0.5861	0.5827	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731 (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	0.1500	9.2190	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) =	85.2075		(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) = 94.1463 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	56.9382	56.6135	56.2951	54.8000	54.5202	53.2180	53.2180	52.9768	53.7196	54.5202	55.0861	55.6778 (38)
Heat transfer coeff	151.0846	150.7598	150.4415	148.9463	148.6666	147.3643	147.3643	147.1232	147.8659	148.6666	149.2325	149.8241 (39)
Average = Sum(39)m / 12 =												148.9450 (39)
HLP	1.2291	1.2265	1.2239	1.2117	1.2095	1.1989	1.1989	1.1969	1.2029	1.2095	1.2141	1.2189 (40)
HLP (average)												1.2117 (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		0.6200	0.7000	0.7700		8.3480 (75)
Southeast					4.2500	36.7938		0.6200	0.7000	0.7700		47.0313 (77)
Southwest					2.8400	36.7938		0.6200	0.7000	0.7700		31.4280 (79)
Northwest					11.6600	11.2829		0.6200	0.7000	0.7700		39.5680 (81)
Southeast					5.8000	36.7938		0.6200	0.7000	0.7700		64.1839 (77)
Solar gains	190.5591	340.5083	508.1734	700.5110	849.3079	871.6155	828.4910	713.1324	574.0951	387.7327	231.1443	161.2034 (83)
Total gains	883.6557	1028.5023	1169.2722	1319.5910	1424.8255	1408.4121	1342.8414	1236.8896	1122.1941	978.0852	868.5346	834.6963 (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	32.8845	32.9553	33.0250	33.3565	33.4193	33.7146	33.7146	33.7699	33.6003	33.4193	33.2926	33.1611
alpha	3.1923	3.1970	3.2017	3.2238	3.2280	3.2476	3.2476	3.2513	3.2400	3.2280	3.2195	3.2107
util living area	0.9769	0.9619	0.9320	0.8661	0.7519	0.5961	0.4583	0.5094	0.7266	0.9021	0.9638	0.9805 (86)
MIT	19.1459	19.3927	19.7790	20.2600	20.6504	20.8834	20.9628	20.9473	20.7695	20.2546	19.6124	19.0974 (87)
Th 2	19.8968	19.8989	19.9009	19.9106	19.9124	19.9209	19.9209	19.9225	19.9176	19.9124	19.9088	19.9049 (88)
util rest of house	0.9723	0.9544	0.9183	0.8386	0.7015	0.5166	0.3556	0.4042	0.6547	0.8758	0.9554	0.9765 (89)
MIT 2	17.4471	17.8039	18.3571	19.0340	19.5484	19.8276	19.9013	19.8924	19.7108	19.0443	18.1319	17.3820 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.6876	18.0288	18.5584	19.2075	19.7044	19.9770	20.0516	20.0417	19.8607	19.2156	18.3415	17.6249 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5376	17.8788	18.4084	19.0575	19.5544	19.8270	19.9016	19.8917	19.7107	19.0656	18.1915	17.4749 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	846.0740	961.5788	1044.9741	1072.2202	972.8521	717.0063	474.9008	496.0346	717.0761	830.7518	813.1204	804.0873 (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	1999.9958	1956.6798	1791.5146	1512.9257	1167.6900	770.2789	486.5327	513.7101	829.6303	1258.5572	1655.2063	1988.8932 (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	858.5178	668.7079	555.4261	317.3079	144.9594	0.0000	0.0000	0.0000	0.0000	318.2872	606.3018	881.4956 (98)
Space heating												4351.0037 (98)
Space heating per m2										(98) / (4) =		35.3970 (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													4834.4486 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	858.5178	668.7079	555.4261	317.3079	144.9594	0.0000	0.0000	0.0000	0.0000	318.2872	606.3018	881.4956	(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)	953.9087	743.0087	617.1401	352.5644	161.0660	0.0000	0.0000	0.0000	0.0000	353.6524	673.6687	979.4395	(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	89.3882	89.3265	89.1978	88.9051	88.3073	86.7000	86.7000	86.7000	86.7000	88.8801	89.2581	86.7000	(216)
Fuel for water heating, kWh/month	210.5591	184.9361	192.6641	170.7192	166.5425	148.8175	140.3263	157.5852	158.4506	177.2011	189.7846	89.4151	(217)
Water heating fuel used												204.5724	(219)
Annual totals kWh/year												2102.1586	(219)
Space heating fuel - main system												4834.4486	(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												6799.8274	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4834.4486	3.4800	168.2388	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2102.1586	3.4800	73.1551	(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			343.3527	(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] =	0.8588 (257)
SAP value	88.0199	
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	4834.4486	0.2160	1044.2409	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2102.1586	0.2160	454.0663	(264)
Space and water heating			1498.3072	(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			1427.3185	(272)
CO2 emissions per m2			11.6100	(273)
EI value			88.6100	
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	$3.48 / 0.8829 = 3.942$, stars = 4
Water heating environmental impact	$0.216 / 0.8829 = 0.2446$, 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					4.9400
Infiltration rate					0.3829 (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) =		0.3254 (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	0.3417	0.3173	0.3254	0.3092	0.3092	0.3010	0.2929	0.2848	0.2766	0.3010	0.2848	0.3010 (22b)
Effective ac	0.5584	0.5503	0.5530	0.5478	0.5478	0.5453	0.5429	0.5405	0.5383	0.5453	0.5405	0.5453 (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	0.1500	9.2190	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) =	85.2075		(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/m ² K							145.5093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9388 (36)
Total fabric heat loss						(33) + (36) =	94.1463 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.2469	53.4656	53.7196	53.2180	53.2180	52.9768	52.7421	52.5138	52.2919	52.9768	52.5138	52.9768 (38)
Heat transfer coeff	148.3933	147.6119	147.8659	147.3643	147.3643	147.1232	146.8884	146.6601	146.4383	147.1232	146.6601	147.1232 (39)
Average = Sum(39)m / 12 =												147.2180 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2072	1.2009	1.2029	1.1989	1.1989	1.1969	1.1950	1.1931	1.1913	1.1969	1.1931	1.1969 (40)
HLP (average)												1.1977 (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	0.6200	0.7000	0.7700	10.8152 (75)		
Southeast					4.2500	45.1778	0.6200	0.7000	0.7700	57.7480 (77)		
Southwest					2.8400	45.1778	0.6200	0.7000	0.7700	38.5893 (79)		
Northwest					11.6600	14.6176	0.6200	0.7000	0.7700	51.2624 (81)		
Southeast					5.8000	45.1778	0.6200	0.7000	0.7700	78.8091 (77)		
Solar gains	237.2240	362.1019	548.2949	765.5457	885.1803	987.6454	931.1261	819.4350	656.0973	445.8711	287.0876	197.1017 (83)
Total gains	930.3206	1050.0959	1209.3937	1384.6257	1460.6980	1524.4421	1445.4765	1343.1921	1204.1963	1036.2236	924.4779	870.5947 (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	33.4809	33.6581	33.6003	33.7146	33.7146	33.7699	33.8239	33.8765	33.9278	33.7699	33.8765	33.7699
alpha	3.2321	3.2439	3.2400	3.2476	3.2476	3.2513	3.2549	3.2584	3.2619	3.2513	3.2584	3.2513
util living area	0.9705	0.9565	0.9188	0.8352	0.7028	0.5116	0.3843	0.4103	0.6554	0.8671	0.9499	0.9748 (86)
MIT	19.3301	19.5222	19.9213	20.3939	20.7456	20.9339	20.9805	20.9764	20.8496	20.4210	19.8236	19.3040 (87)
Th 2	19.9142	19.9193	19.9176	19.9209	19.9209	19.9225	19.9240	19.9255	19.9269	19.9225	19.9255	19.9225 (88)
util rest of house	0.9645	0.9479	0.9025	0.8025	0.6448	0.4276	0.2834	0.3039	0.5739	0.8318	0.9380	0.9696 (89)
MIT 2	17.7243	18.0029	18.5690	19.2208	19.6707	19.8759	19.9156	19.9152	19.8040	19.2758	18.4447	17.6925 (90)
Living area fraction	17.9516	18.2179	18.7604	19.3869	19.8228	20.0257	20.0663	20.0654	19.9520	19.4379	18.6399	17.9206 (91)
MIT	17.9516	18.2179	18.7604	19.3869	19.8228	20.0257	20.0663	20.0654	19.9520	19.4379	18.6399	17.9206 (92)
Temperature adjustment	17.8016	18.0679	18.6104	19.2369	19.6728	19.8757	19.9163	19.9154	19.8020	19.2879	18.4899	17.7706 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9476	0.9275	0.8772	0.7780	0.6300	0.4238	0.2827	0.3028	0.5633	0.8061	0.9161	0.9543 (94)
Ext temp.	881.6100	973.9971	1060.8968	1077.2578	920.2204	645.9861	408.6272	406.7416	678.3649	835.3103	846.9508	830.7725 (95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Month fracti	1914.5148	1884.6983	1716.7884	1434.8645	1057.0171	673.1886	413.6835	412.9069	747.1276	1160.4933	1553.1094	1878.8530 (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	768.4811	611.9912	487.9834	257.4768	101.7768	0.0000	0.0000	0.0000	0.0000	241.9362	508.4342	779.7719 (98)
Space heating per m2												3757.8515 (98)
												(98) / (4) = 30.5715 (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													4175.3905 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	768.4811	611.9912	487.9834	257.4768	101.7768	0.0000	0.0000	0.0000	0.0000	241.9362	508.4342	779.7719	(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)	853.8679	679.9902	542.2037	286.0853	113.0853	0.0000	0.0000	0.0000	0.0000	268.8180	564.9269	866.4132	(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	89.3311	89.2777	89.1166	88.7472	88.0200	86.7000	86.7000	86.7000	86.7000	88.6693	89.1520	86.7000	(216)
Fuel for water heating, kWh/month	210.6938	185.0371	192.8397	171.0228	167.0861	148.8175	140.3263	157.5852	158.4506	177.6225	190.0105	204.7129	(219)
Water heating fuel used												2104.2049	(219)
Annual totals kWh/year													
Space heating fuel - main system												4175.3905	(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												6060.4912	(238)

10a. Fuel costs - using BEDF prices (435)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4175.3905	3.9400	164.5104	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2104.2049	3.9400	82.9057	(247)
Pumps and fans for heating	75.0000	16.5500	12.4125	(249)
Energy for lighting	455.1332	16.5500	75.3245	(250)
Additional standing charges			87.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	16.5500	-123.9988	(252)
Total energy cost			298.1543	(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	4175.3905	0.2160	901.8844	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2104.2049	0.2160	454.5083	(264)
Space and water heating			1356.3926	(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			1242.6775	(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	4175.3905	1.2200	5093.9764	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2104.2049	1.2200	2567.1300	(264)
Space and water heating			7661.1064	(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			6988.4563	(272)
Primary energy kWh/m2/year			56.8537	(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 (16.1%)

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 435 TEST (16 Nov 2018)
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	£88	£96	-£8
Mains gas	£334	£293	£41
Space heating	£264	£264	£0
Water heating	£83	£50	£33
Lighting	£75	£75	£0
Generated (PV)	-£124	-£124	£0
Total cost of fuels	£298	£265	£33
Total cost of uses	£298	£265	£33
Delivered energy	49 kWh/m²	41 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	57 kWh/m²	48 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					4.9400
Infiltration rate					0.3829 (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) =	0.3254 (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	0.4149	0.4068	0.3987	0.3580	0.3498	0.3092	0.3092	0.3010	0.3254	0.3498	0.3661	0.3824 (22b)
Effective ac	0.5861	0.5827	0.5795	0.5641	0.5612	0.5478	0.5478	0.5453	0.5530	0.5612	0.5670	0.5731 (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	0.1500	9.2190	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) =	85.2075		(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/m ² K							145.5093 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9388 (36)
Total fabric heat loss						(33) + (36) =	94.1463 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	56.9382	56.6135	56.2951	54.8000	54.5202	53.2180	53.2180	52.9768	53.7196	54.5202	55.0861	55.6778 (38)
Heat transfer coeff	151.0846	150.7598	150.4415	148.9463	148.6666	147.3643	147.3643	147.1232	147.8659	148.6666	149.2325	149.8241 (39)
Average = Sum(39)m / 12 =												148.9450 (39)
HLP	1.2291	1.2265	1.2239	1.2117	1.2095	1.1989	1.1989	1.1969	1.2029	1.2095	1.2141	1.2189 (40)
HLP (average)												1.2117 (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	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		0.6200	0.7000	0.7700		8.3480 (75)
Southeast					4.2500	36.7938		0.6200	0.7000	0.7700		47.0313 (77)
Southwest					2.8400	36.7938		0.6200	0.7000	0.7700		31.4280 (79)
Northwest					11.6600	11.2829		0.6200	0.7000	0.7700		39.5680 (81)
Southeast					5.8000	36.7938		0.6200	0.7000	0.7700		64.1839 (77)

Solar gains	190.5591	340.5083	508.1734	700.5110	849.3079	871.6155	828.4910	713.1324	574.0951	387.7327	231.1443	161.2034 (83)
Total gains	883.6557	1028.5023	1169.2722	1319.5910	1424.8255	1408.4121	1342.8414	1236.8896	1122.1941	978.0852	868.5346	834.6963 (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	32.8845	32.9553	33.0250	33.3565	33.4193	33.7146	33.7146	33.7699	33.6003	33.4193	33.2926	33.1611	
alpha	3.1923	3.1970	3.2017	3.2238	3.2280	3.2476	3.2476	3.2513	3.2400	3.2280	3.2195	3.2107	
util living area	0.9769	0.9619	0.9320	0.8661	0.7519	0.5961	0.4583	0.5094	0.7266	0.9021	0.9638	0.9805 (86)	
MIT	19.1459	19.3927	19.7790	20.2600	20.6504	20.8834	20.9628	20.9473	20.7695	20.2546	19.6124	19.0974 (87)	
Th 2	19.8968	19.8989	19.9009	19.9106	19.9124	19.9209	19.9209	19.9225	19.9176	19.9124	19.9088	19.9049 (88)	
util rest of house	0.9723	0.9544	0.9183	0.8386	0.7015	0.5166	0.3556	0.4042	0.6547	0.8758	0.9554	0.9765 (89)	
MIT 2	17.4471	17.8039	18.3571	19.0340	19.5484	19.8276	19.9013	19.8924	19.7108	19.0443	18.1319	17.3820 (90)	
Living area fraction									fLA = Living area / (4) =				0.1416 (91)
MIT	17.6876	18.0288	18.5584	19.2075	19.7044	19.9770	20.0516	20.0417	19.8607	19.2156	18.3415	17.6249 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.5376	17.8788	18.4084	19.0575	19.5544	19.8270	19.9016	19.8917	19.7107	19.0656	18.1915	17.4749 (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	0.9575	0.9349	0.8937	0.8125	0.6828	0.5091	0.3537	0.4010	0.6390	0.8494	0.9362	0.9633	(94)
Useful gains	846.0740	961.5788	1044.9741	1072.2202	972.8521	717.0063	474.9008	496.0346	717.0761	830.7518	813.1204	804.0873	(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	1999.9958	1956.6798	1791.5146	1512.9257	1167.6900	770.2789	486.5327	513.7101	829.6303	1258.5572	1655.2063	1988.8932	(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	858.5178	668.7079	555.4261	317.3079	144.9594	0.0000	0.0000	0.0000	0.0000	318.2872	606.3018	881.4956	(98)
Space heating												4351.0037	(98)
Space heating per m2											(98) / (4) =	35.3970	(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													4834.4486 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	858.5178	668.7079	555.4261	317.3079	144.9594	0.0000	0.0000	0.0000	0.0000	318.2872	606.3018	881.4956	(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)	953.9087	743.0087	617.1401	352.5644	161.0660	0.0000	0.0000	0.0000	0.0000	353.6524	673.6687	979.4395	(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	89.4576	89.4724	89.4835	89.5004	89.4665	86.7000	86.7000	86.7000	86.7000	89.1700	89.3652	86.7000	(216)
(217)m	89.4576	89.4724	89.4835	89.5004	89.4665	86.7000	86.7000	86.7000	86.7000	89.1700	89.3652	89.4725	(217)
Fuel for water heating, kWh/month	181.8547	137.0153	110.9582	60.9266	30.0971	12.5788	5.8879	40.1258	66.4563	115.5439	155.6682	180.5611	(219)
Water heating fuel used												1097.6740	(219)
Annual totals kWh/year													
Space heating fuel - main system												4834.4486	(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												5845.3428	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4834.4486	3.4800	168.2388	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1097.6740	3.4800	38.1991	(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			314.9916	(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] =	0.7879 (257)
SAP value			89.0094
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	4834.4486	0.2160	1044.2409 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1097.6740	0.2160	237.0976 (264)
Space and water heating			1281.3385 (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			1236.2998 (272)
CO2 emissions per m2			10.0600 (273)
EI value			90.1343
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					4.9400
Infiltration rate					0.3829 (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) =	0.3254 (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	0.3417	0.3173	0.3254	0.3092	0.3092	0.3010	0.2929	0.2848	0.2766	0.3010	0.2848	0.3010 (22b)
Effective ac	0.5584	0.5503	0.5530	0.5478	0.5478	0.5453	0.5429	0.5405	0.5383	0.5453	0.5405	0.5453 (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	0.1500	9.2190	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) =	85.2075		(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) = 94.1463 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	54.2469	53.4656	53.7196	53.2180	53.2180	52.9768	52.7421	52.5138	52.2919	52.9768	52.5138	52.9768 (38)
Heat transfer coeff	148.3933	147.6119	147.8659	147.3643	147.3643	147.1232	146.8884	146.6601	146.4383	147.1232	146.6601	147.1232 (39)
Average = Sum(39)m / 12 =												147.2180 (39)
HLP	1.2072	1.2009	1.2029	1.1989	1.1989	1.1969	1.1950	1.1931	1.1913	1.1969	1.1931	1.1969 (40)
HLP (average)												1.1977 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.8739 (42)
 Average daily hot water use (litres/day) 102.4557 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.7013	108.6031	104.5048	100.4066	96.3084	92.2101	92.2101	96.3084	100.4066	104.5048	108.6031	112.7013 (44)
Energy conte	167.1328	146.1754	150.8399	131.5059	126.1830	108.8863	100.8992	115.7833	117.1661	136.5458	149.0505	161.8591 (45)
Energy content (annual)										Total = Sum(45)m =		1612.0273 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Distribution loss (46)m = 0.15 x (45)m	25.0699	21.9263	22.6260	19.7259	18.9275	16.3330	15.1349	17.3675	17.5749	20.4819	22.3576	24.2789 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0823	19.0215	21.0122	20.2722	20.8861	20.1384	20.7637	20.8431	20.2105	20.9507	20.3476	21.0596 (61)
Total heat required for water heating calculated for each month	188.2150	165.1968	171.8521	151.7780	147.0692	129.0248	121.6629	136.6264	137.3766	157.4966	169.3981	182.9187 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2591 (H8)
Utilisation factor												0.5481 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												102.4557 (H14)
Volume ratio Veff/V												0.7320 (H15)
Solar storage volume factor												0.9376 (H16)
Solar input												-917.1094 (H17)
Solar input	-29.9183	-42.5420	-73.1194	-98.6550	-115.8762	-123.7741	-121.1711	-108.4518	-84.9103	-58.7041	-35.3855	-24.6016 (63)
Solar input (sum of months) = Sum (63)m =												-917.1094 (63)
Output from w/h	158.2967	122.6549	98.7327	53.1230	31.1929	5.2507	0.4918	28.1746	52.4664	98.7925	134.0126	158.3172 (64)
Total per year (kWh/year) = Sum (64)m =												941.5058 (64)
Heat gains from water heating, kWh/month	60.8422	53.3587	55.4073	48.7937	47.1774	41.2393	38.7399	43.7087	44.0104	50.6392	54.6462	59.0831 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355	172.4355 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4288	57.2251	46.5386	35.2327	26.3369	22.2347	24.0254	31.2291	41.9156	53.2215	62.1173	66.2195 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	431.2946	435.7701	424.4920	400.4823	370.1744	341.6892	322.6593	318.1838	329.4619	353.4716	383.7796	412.2648 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175	55.1175 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570	-114.9570 (71)
Water heating gains (Table 5)	81.7772	79.4028	74.4722	67.7691	63.4105	57.2768	52.0698	58.7483	61.1255	68.0634	75.8975	79.4127 (72)
Total internal gains	693.0966	687.9940	661.0988	619.0801	575.5177	536.7967	514.3504	523.7571	548.0990	590.3525	637.3903	673.4929 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W		
Northeast					2.4600	14.6176	0.6200	0.7000			0.7700			10.8152 (75)		
Southeast					4.2500	45.1778	0.6200	0.7000			0.7700			57.7480 (77)		
Southwest					2.8400	45.1778	0.6200	0.7000			0.7700			38.5893 (79)		
Northwest					11.6600	14.6176	0.6200	0.7000			0.7700			51.2624 (81)		
Southeast					5.8000	45.1778	0.6200	0.7000			0.7700			78.8091 (77)		
Solar gains					237.2240	362.1019	548.2949	765.5457	885.1803	987.6454	931.1261	819.4350	656.0973	445.8711	287.0876	197.1017 (83)
Total gains					930.3206	1050.0959	1209.3937	1384.6257	1460.6980	1524.4421	1445.4765	1343.1921	1204.1963	1036.2236	924.4779	870.5947 (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	33.4809	33.6581	33.6003	33.7146	33.7146	33.7699	33.8239	33.8765	33.9278	33.7699	33.8765	33.7699
alpha	3.2321	3.2439	3.2400	3.2476	3.2476	3.2513	3.2549	3.2584	3.2619	3.2513	3.2584	3.2513
util living area	0.9705	0.9565	0.9188	0.8352	0.7028	0.5116	0.3843	0.4103	0.6554	0.8671	0.9499	0.9748 (86)
MIT	19.3301	19.5222	19.9213	20.3939	20.7456	20.9339	20.9805	20.9764	20.8496	20.4210	19.8236	19.3040 (87)
Th 2	19.9142	19.9193	19.9176	19.9209	19.9209	19.9225	19.9240	19.9255	19.9269	19.9225	19.9255	19.9225 (88)
util rest of house	0.9645	0.9479	0.9025	0.8025	0.6448	0.4276	0.2834	0.3039	0.5739	0.8318	0.9380	0.9696 (89)
MIT 2	17.7243	18.0029	18.5690	19.2208	19.6707	19.8759	19.9156	19.9152	19.8040	19.2758	18.4447	17.6925 (90)
Living area fraction									fLA = Living area / (4) =			0.1416 (91)
MIT	17.9516	18.2179	18.7604	19.3869	19.8228	20.0257	20.0663	20.0654	19.9520	19.4379	18.6399	17.9206 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8016	18.0679	18.6104	19.2369	19.6728	19.8757	19.9163	19.9154	19.8020	19.2879	18.4899	17.7706 (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	0.9476	0.9275	0.8772	0.7780	0.6300	0.4238	0.2827	0.3028	0.5633	0.8061	0.9161	0.9543	(94)
Useful gains	881.6100	973.9971	1060.8968	1077.2578	920.2204	645.9861	408.6272	406.7416	678.3649	835.3103	846.9508	830.7725	(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	1914.5148	1884.6983	1716.7884	1434.8645	1057.0171	673.1886	413.6835	412.9069	747.1276	1160.4933	1553.1094	1878.8530	(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	768.4811	611.9912	487.9834	257.4768	101.7768	0.0000	0.0000	0.0000	0.0000	241.9362	508.4342	779.7719	(98)
Space heating												3757.8515	(98)
Space heating per m2											(98) / (4) =	30.5715	(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													4175.3905	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	768.4811	611.9912	487.9834	257.4768	101.7768	0.0000	0.0000	0.0000	0.0000	241.9362	508.4342	779.7719	(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)	853.8679	679.9902	542.2037	286.0853	113.0853	0.0000	0.0000	0.0000	0.0000	268.8180	564.9269	866.4132	(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	89.4187	89.4317	89.4272	89.4179	89.2035	86.7000	86.7000	86.7000	86.7000	89.0176	89.2911	86.7000	(216)	
(217)m	89.4187	89.4317	89.4272	89.4179	89.2035	86.7000	86.7000	86.7000	86.7000	89.0176	89.2911	86.7000	(217)	
Fuel for water heating, kWh/month	177.0287	137.1493	110.4057	59.4099	34.9683	6.0561	0.5672	32.4966	60.5148	110.9809	150.0851	177.0379	(219)	
Water heating fuel used												1056.7004	(219)	
Annual totals kWh/year														
Space heating fuel - main system												4175.3905	(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													5062.9866	(238)

10a. Fuel costs - using BEDF prices (435)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4175.3905	3.9400	164.5104	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1056.7004	3.9400	41.6340	(247)
Pumps and fans for heating	75.0000	16.5500	12.4125	(249)
Pump for solar water heating	50.0000	16.5500	8.2750	(249)
Energy for lighting	455.1332	16.5500	75.3245	(250)
Additional standing charges			87.0000	(251)
Energy saving/generation technologies				
PV Unit	-749.2375	16.5500	-123.9988	(252)
Total energy cost			265.1576	(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	4175.3905	0.2160	901.8844	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1056.7004	0.2160	228.2473	(264)
Space and water heating			1130.1316	(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				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

PV Unit	-749.2375	0.5190	-388.8543 (269)
Total kg/year			1042.3665 (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	4175.3905	1.2200	5093.9764 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1056.7004	1.2200	1289.1745 (264)
Space and water heating			6383.1509 (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			5864.0008 (272)
Primary energy kWh/m2/year			47.7058 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-178	Issued on Date	03/12/2018
Assessment Reference	As Built	Prop Type Ref	P404 - Det (Op)
Property	10, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE		
SAP Rating	88 B	DER	12.92
Environmental	89 B	% DER<TER	20.27
CO ₂ Emissions (t/year)	1.24	DFEE	48.11
General Requirements Compliance	Pass	% DFEE<TFEE	9.36
Assessor	Silvio Junges, Tel: 01884 242050	Assessor ID	P637-0001
Client			

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

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	94.15 (37)
Summer heat loss coefficient	482.75 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	2.4600	106.0502	0.6200	0.7000	0.9000	91.7110
South East	4.2500	127.3119	0.6200	0.7000	0.9000	190.2096
South West	2.8400	127.3119	0.6200	0.7000	0.9000	127.1048
North West	11.6600	106.0502	0.6200	0.7000	0.9000	434.6952
South East	5.8000	127.3119	0.6200	0.7000	0.9000	259.5802
total:						1103.3009

	Jun	Jul	Aug	
Solar gains	1190	1103	968	(P3)
Internal gains	534	511	521	
Total summer gains	1723	1615	1489	(P5)
Summer gain/loss ratio	3.57	3.34	3.08	(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	19.95	21.63	21.36	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			