

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-139				Issued on Date	29/05/2019
Assessment Reference	As Built	Prop Type Ref	P402 - Det (As)			
Property	27, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	87 B	DER	13.99	TER	17.32	
Environmental	88 B	% DER<TER	19.24			
CO ₂ Emissions (t/year)	1.21	DFEE	49.11	TFEE	54.73	
General Requirements Compliance	Pass	% DFEE<TFEE	10.28			
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk				Assessor ID	T511-0001
Client						

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

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DWELLING AS BUILT

Detached House, total floor area 110 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) 17.32 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.99 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.1 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	1.35 (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: 4.51 (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: 1.44 m², No overhang
Windows facing South East: 6.24 m², No overhang
Windows facing South West: 0.57 m², No overhang
Windows facing North West: 10.74 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Door U-value 0.90 W/m²K
Thermal bridging y-value 0.032 W/m²K
Photovoltaic array 0.81 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1516 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.3771 (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)	=	0.3206 (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	0.4087	0.4007	0.3927	0.3526	0.3446	0.3045	0.3045	0.2965	0.3206	0.3446	0.3606	0.3767 (22b)
Effective ac	0.5835	0.5803	0.5771	0.5622	0.5594	0.5464	0.5464	0.5440	0.5514	0.5594	0.5650	0.5709 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			14.8900	1.3258	19.7405		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			55.0700	0.1500	8.2605	75.0000	4130.2500 (28a)
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.2500	30.2850	60.0000	7268.4000 (29a)
External Roof 1	55.0700		55.0700	0.1300	7.1591	9.0000	495.6300 (30)
Total net area of external elements Aum(A, m ²)			252.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7977		(33)
GF			45.6300			9.0000	410.6700 (32c)
GF			29.4300			39.0000	1147.7700 (32c)
FF			136.5500			9.0000	1228.9500 (32c)
Internal Floor 1			55.0700			18.0000	991.2600 (32d)
Internal Floor 1			55.0700			18.0000	991.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16664.1900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.3001 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1089 (36)
Total fabric heat loss							(33) + (36) = 80.9067 (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	50.7956	50.5132	50.2365	48.9366	48.6934	47.5612	47.5612	47.3516	47.9973	48.6934	49.1854	49.6998 (38)
Heat transfer coeff	131.7022	131.4199	131.1432	129.8433	129.6001	128.4679	128.4679	128.2582	128.9040	129.6001	130.0921	130.6064 (39)
Average = Sum(39)m / 12 =												129.8421 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1958	1.1932	1.1907	1.1789	1.1767	1.1664	1.1664	1.1645	1.1704	1.1767	1.1812	1.1858 (40)
HLP (average)												1.1789 (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												2.8157 (42)
Average daily hot water use (litres/day)												101.0720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy conte	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)

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Energy content (annual)												Total = Sum(45)m = 1590.2563 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.7313	21.6302	22.3204	19.4595	18.6718	16.1124	14.9305	17.1329	17.3376	20.2053	22.0556	23.9510 (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	21.0726	19.0130	21.0034	20.2592	20.8721	20.1269	20.7529	20.8302	20.1990	20.9428	20.3390	21.0502 (61)
Total heat required for water heating calculated for each month	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (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	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (64)
	Total per year (kWh/year) = Sum(64)m = 1836.7176 (64)											
Heat gains from water heating, kWh/month	60.0893	52.7002	54.7278	48.2000	46.6073	40.7475	38.2841	43.1856	43.4813	50.0240	53.9747	58.3539 (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	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9244	22.1376	18.0035	13.6298	10.1885	8.6015	9.2943	12.0810	16.2151	20.5888	24.0302	25.6171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	80.7651	78.4228	73.5588	66.9444	62.6442	56.5937	51.4572	58.0451	60.3908	67.2366	74.9649	78.4326	(72)
Total internal gains	445.6815	443.3724	427.2681	401.1515	374.3130	348.7272	332.2927	338.8475	352.4335	378.7814	409.0480	432.0511	(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				1.4400	11.2829	0.6200	0.7000	0.7700	4.8866 (75)				
Southeast				6.2400	36.7938	0.6200	0.7000	0.7700	69.0530 (77)				
Southwest				0.5700	36.7938	0.6200	0.7000	0.7700	6.3077 (79)				
Northwest				6.6400	11.2829	0.6200	0.7000	0.7700	22.5327 (81)				
Northwest				4.1000	11.2829	0.6200	0.7000	0.7700	13.9133 (81)				
Solar gains	116.6933	212.5009	327.2197	466.5649	578.3825	598.7406	567.0371	479.8643	374.8836	244.6911	142.2719	98.2474	(83)
Total gains	562.3748	655.8733	754.4878	867.7164	952.6955	947.4677	899.3298	818.7118	727.3170	623.4726	551.3199	530.2985	(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	35.1470	35.2225	35.2969	35.6502	35.7171	36.0319	36.0319	36.0908	35.9100	35.7171	35.5820	35.4419
alpha	3.3431	3.3482	3.3531	3.3767	3.3811	3.4021	3.4021	3.4061	3.3940	3.3811	3.3721	3.3628
util living area	0.9922	0.9862	0.9723	0.9348	0.8529	0.7153	0.5733	0.6343	0.8431	0.9589	0.9873	0.9936 (86)
MIT	18.9897	19.1997	19.5676	20.0652	20.5166	20.8217	20.9387	20.9127	20.6595	20.0769	19.4460	18.9527 (87)
Th 2	19.9234	19.9254	19.9275	19.9369	19.9387	19.9470	19.9470	19.9485	19.9438	19.9387	19.9351	19.9314 (88)
util rest of house	0.9905	0.9832	0.9658	0.9184	0.8136	0.6368	0.4570	0.5198	0.7858	0.9455	0.9839	0.9922 (89)
MIT 2	17.2316	17.5385	18.0734	18.7908	19.4112	19.7960	19.9127	19.8950	19.6155	18.8196	17.9052	17.1824 (90)
Living area fraction	17.6737	17.9562	18.4492	19.1113	19.6892	20.0539	20.1707	20.1510	19.8781	19.1358	18.2927	17.6277 (91)
MIT	17.6737	17.9562	18.4492	19.1113	19.6892	20.0539	20.1707	20.1510	19.8781	19.1358	18.2927	17.6277 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5237	17.8062	18.2992	18.9613	19.5392	19.9039	20.0207	20.0010	19.7281	18.9858	18.1427	17.4777 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9844	0.9741	0.9518	0.8988	0.7959	0.6332	0.4658	0.5261	0.7714	0.9286	0.9752	0.9870	(94)
Ext temp.	553.6114	638.8931	718.1168	779.8756	758.2470	599.9727	418.9164	430.7086	561.0811	578.9673	537.6665	523.4103	(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	1741.5946	1696.1372	1547.3839	1306.3889	1015.9565	681.3842	439.4528	461.8520	725.4805	1086.7979	1436.5698	1734.1475	(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	883.8595	710.4680	616.9748	379.0896	191.7358	0.0000	0.0000	0.0000	0.0000	377.8260	647.2104	900.7885	(98)
Space heating per m2	(98) / (4) = 42.7452 (99)												

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5231.0583 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	883.8595	710.4680	616.9748	379.0896	191.7358	0.0000	0.0000	0.0000	0.0000	377.8260	647.2104	900.7885	(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)	982.0661	789.4089	685.5275	421.2106	213.0398	0.0000	0.0000	0.0000	0.0000	419.8066	719.1226	1000.8761	(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	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234	(64)
Efficiency of water heater (217)m	89.4085	89.3646	89.2667	89.0392	88.5467	86.7000	86.7000	86.7000	86.7000	89.0115	89.3016	89.4312	(216)
Fuel for water heating, kWh/month	207.9759	182.6386	190.2234	168.4528	164.1517	147.1080	138.7422	155.7668	156.6122	174.8589	187.4283	202.0809	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													5231.0583 (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 (219)
Electricity for lighting (calculated in Appendix L)													440.1730 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895			-588.2895 (233)
Total delivered energy for all uses													7233.9814 (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	5231.0583	0.2160	1129.9086 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2076.0397	0.2160	448.4246 (264)
Space and water heating			1578.3332 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.1730	0.5190	228.4498 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total CO2, kg/year			1540.3857 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9900 (273)

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

DER			13.9900 ZC1
Total Floor Area		TFA	110.1400
Assumed number of occupants		N	2.8157
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.6212 ZC2
CO2 emissions from cooking, equation (L16)			1.6940 ZC3
Total CO2 emissions			30.3052 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			30.3052 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	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (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) =	0.1516 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.4016 (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) =					0.3414 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)					
Adj infilt rate	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)					
	0.4353	0.4267	0.4182	0.3755	0.3670	0.3243	0.3243	0.3158	0.3414	0.3670	0.3841	0.4011 (22b)					
Effective ac	0.5947	0.5911	0.5874	0.5705	0.5673	0.5526	0.5526	0.5499	0.5583	0.5673	0.5738	0.5805 (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 Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			18.9900	1.3258	25.1761		(27)					
Heat Loss Floor 1			55.0700	0.1300	7.1591		(28a)					
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.1800	21.8052		(29a)					
External Roof 1	55.0700		55.0700	0.1300	7.1591		(30)					
Total net area of external elements Aum(A, m2)			252.4000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	63.4295		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0109 (36)					
Total fabric heat loss						(33) + (36) =	74.4404 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.7710	Feb 51.4507	Mar 51.1369	Apr 49.6626	May 49.3868	Jun 48.1027	Jul 48.1027	Aug 47.8649	Sep 48.5973	Oct 49.3868	Nov 49.9448	Dec 50.5281 (38)
Heat transfer coeff	126.2114	125.8912	125.5773	124.1030	123.8272	122.5432	122.5432	122.3054	123.0378	123.8272	124.3852	124.9686 (39)
Average = Sum(39)m / 12 =												124.1017 (39)
HLP	Jan 1.1459	Feb 1.1430	Mar 1.1402	Apr 1.1268	May 1.1243	Jun 1.1126	Jul 1.1126	Aug 1.1105	Sep 1.1171	Oct 1.1243	Nov 1.1293	Dec 1.1346 (40)
HLP (average)												1.1268 (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												2.8157 (42)
Average daily hot water use (litres/day)												101.0720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content (annual)	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy content (annual)	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1590.2563 (45)
Water storage loss:	24.7313	21.6302	22.3204	19.4595	18.6718	16.1124	14.9305	17.1329	17.3376	20.2053	22.0556	23.9510 (46)
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.8469	48.4149	44.8594	46.3547	48.4149	48.8469	50.9589	49.3151	50.9589 (61)
Solar input	215.8345	190.2286	199.7616	178.5767	172.8937	152.2752	145.8912	162.6345	164.4306	185.6606	196.3525	210.6321 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	215.8345	190.2286	199.7616	178.5767	172.8937	152.2752	145.8912	162.6345	164.4306	185.6606	196.3525	210.6321 (64)
Heat gains from water heating, kWh/month	67.5609	59.4538	62.2166	55.3469	53.4929	46.9306	44.6846	50.0817	50.6433	57.5281	61.2187	65.8311 (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	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9244	22.1376	18.0035	13.6298	10.1885	8.6015	9.2943	12.0810	16.2151	20.5888	24.0302	25.6171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	90.8076	88.4728	83.6245	76.8707	71.8991	65.1814	60.0599	67.3142	70.3379	77.3227	85.0260	88.4826	(72)
Total internal gains	455.7240	453.4224	437.3337	411.0778	383.5679	357.3148	340.8954	348.1165	362.3806	388.8675	419.1091	442.1011	(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				1.4400	11.2829	0.6300	0.7000	0.7700	4.9654 (75)				
Southeast				6.2400	36.7938	0.6300	0.7000	0.7700	70.1668 (77)				
Southwest				0.5700	36.7938	0.6300	0.7000	0.7700	6.4095 (79)				
Northwest				10.7400	11.2829	0.6300	0.7000	0.7700	37.0338 (81)				
Solar gains	118.5755	215.9283	332.4975	474.0901	587.7113	608.3977	576.1829	487.6041	380.9301	248.6378	144.5666	99.8320	(83)
Total gains	574.2994	669.3508	769.8312	885.1679	971.2792	965.7125	917.0783	835.7206	743.3107	637.5052	563.6757	541.9331	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.6016	60.7557	60.9076	61.6311	61.7684	62.4156	62.4156	62.5370	62.1647	61.7684	61.4913	61.2043	
alpha	5.0401	5.0504	5.0605	5.1087	5.1179	5.1610	5.1610	5.1691	5.1443	5.1179	5.0994	5.0803	
util living area	0.9990	0.9975	0.9926	0.9713	0.8988	0.7400	0.5717	0.6420	0.8874	0.9860	0.9978	0.9992	(86)
MIT	19.6910	19.8396	20.0973	20.4503	20.7613	20.9402	20.9872	20.9776	20.8376	20.4352	20.0015	19.6678	(87)
Th 2	19.9635	19.9659	19.9682	19.9790	19.9811	19.9905	19.9905	19.9923	19.9869	19.9811	19.9769	19.9726	(88)
util rest of house	0.9986	0.9966	0.9898	0.9597	0.8584	0.6503	0.4489	0.5166	0.8262	0.9785	0.9968	0.9990	(89)
MIT 2	18.2095	18.4283	18.8054	19.3200	19.7405	19.9496	19.9857	19.9827	19.8485	19.3062	18.6734	18.1821	(90)
Living area fraction	18.5821	18.7832	19.1303	19.6043	19.9972	20.1988	20.2376	20.2329	20.0972	19.5902	19.0074	18.5557	(92)
Temperature adjustment	18.5821	18.7832	19.1303	19.6043	19.9972	20.1988	20.2376	20.2329	20.0972	19.5902	19.0074	18.5557	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	573.0712	666.0991	759.4865	844.6557	834.4401	647.3441	440.1614	458.1183	620.0445	621.2574	561.1364	541.0683	(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	1802.5600	1747.7768	1586.0821	1328.4355	1027.4236	686.0891	445.7611	468.7854	737.8856	1113.2270	1481.1101	1794.0156	(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	914.7397	726.8874	614.9872	348.3215	143.5797	0.0000	0.0000	0.0000	0.0000	366.0254	662.3811	932.1928	(98)
Space heating												4709.1147	(98)
Space heating per m2												42.7557	(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													5041.8787 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	914.7397	726.8874	614.9872	348.3215	143.5797	0.0000	0.0000	0.0000	0.0000	366.0254	662.3811	932.1928	(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)	979.3787	778.2520	658.4445	372.9352	153.7256	0.0000	0.0000	0.0000	0.0000	391.8902	709.1874	998.0651	(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	215.8345	190.2286	199.7616	178.5767	172.8937	152.2752	145.8912	162.6345	164.4306	185.6606	196.3525	210.6321	(64)
Efficiency of water heater (217)m	88.2802	88.1015	87.6956	86.7039	84.5876	80.3000	80.3000	80.3000	80.3000	86.7289	87.8728	88.3518	(216)
Fuel for water heating, kWh/month	244.4879	215.9198	227.7898	205.9615	204.3961	189.6328	181.6827	202.5336	204.7704	214.0701	223.4509	238.4015	(219)
Water heating fuel used												2553.0971	(219)
Annual totals kWh/year													
Space heating fuel - main system												5041.8787	(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)												440.1730	(232)
Total delivered energy for all uses												8110.1488	(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	5041.8787	0.2160	1089.0458 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2553.0971	0.2160	551.4690 (264)
Space and water heating			1640.5148 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.1730	0.5190	228.4498 (268)
Total CO2, kg/m2/year			1907.8896 (272)
Emissions per m2 for space and water heating			14.8948 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0742 (272b)
Emissions per m2 for pumps and fans			0.3534 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8948 * 1.00) + 2.0742 + 0.3534, rounded to 2 d.p.			17.3200 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1516 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.3771 (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) =	0.3206 (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	0.4087	0.4007	0.3927	0.3526	0.3446	0.3045	0.3045	0.2965	0.3206	0.3446	0.3606	0.3767 (22b)
Effective ac	0.5835	0.5803	0.5771	0.5622	0.5594	0.5464	0.5464	0.5440	0.5514	0.5594	0.5650	0.5709 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			14.8900	1.3258	19.7405		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			55.0700	0.1500	8.2605	75.0000	4130.2500 (28a)
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.2500	30.2850	60.0000	7268.4000 (29a)
External Roof 1	55.0700		55.0700	0.1300	7.1591	9.0000	495.6300 (30)
Total net area of external elements Aum(A, m ²)			252.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7977		(33)
GF			45.6300			9.0000	410.6700 (32c)
GF			29.4300			39.0000	1147.7700 (32c)
FF			136.5500			9.0000	1228.9500 (32c)
Internal Floor 1			55.0700			18.0000	991.2600 (32d)
Internal Floor 1			55.0700			9.0000	495.6300 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16168.5600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							146.8001 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1089 (36)
Total fabric heat loss							(33) + (36) = 80.9067 (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	50.7956	50.5132	50.2365	48.9366	48.6934	47.5612	47.5612	47.3516	47.9973	48.6934	49.1854	49.6998 (38)
Heat transfer coeff	131.7022	131.4199	131.1432	129.8433	129.6001	128.4679	128.4679	128.2582	128.9040	129.6001	130.0921	130.6064 (39)
Average = Sum(39)m / 12 =												129.8421 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1958	1.1932	1.1907	1.1789	1.1767	1.1664	1.1664	1.1645	1.1704	1.1767	1.1812	1.1858 (40)
HLP (average)												1.1789 (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												2.8157 (42)
Average daily hot water use (litres/day)												101.0720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy conte	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1590.2563 (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	35.0361	30.6428	31.6206	27.5676	26.4518	22.8259	21.1515	24.2717	24.5615	28.6241	31.2455	33.9306 (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	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9244	22.1376	18.0035	13.6298	10.1885	8.6015	9.2943	12.0810	16.2151	20.5888	24.0302	25.6171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	47.0915	45.5993	42.5008	38.2883	35.5534	31.7026	28.4295	32.6232	34.1133	38.4733	43.3965	45.6056	(72)
Total internal gains	409.0079	407.5489	393.2100	369.4954	344.2222	320.8360	306.2650	310.4255	323.1560	347.0181	374.4796	396.2240	(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				1.4400	11.2829	0.6200	0.7000			0.7700			4.8866 (75)
Southeast				6.2400	36.7938	0.6200	0.7000			0.7700			69.0530 (77)
Southwest				0.5700	36.7938	0.6200	0.7000			0.7700			6.3077 (79)
Northwest				6.6400	11.2829	0.6200	0.7000			0.7700			22.5327 (81)
Northwest				4.1000	11.2829	0.6200	0.7000			0.7700			13.9133 (81)
Solar gains	116.6933	212.5009	327.2197	466.5649	578.3825	598.7406	567.0371	479.8643	374.8836	244.6911	142.2719	98.2474	(83)
Total gains	525.7012	620.0498	720.4297	836.0603	922.6048	919.5766	873.3021	790.2899	698.0395	591.7092	516.7515	494.4714	(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	34.1017	34.1749	34.2471	34.5899	34.6548	34.9602	34.9602	35.0174	34.8420	34.6548	34.5238	34.3878	
alpha	3.2734	3.2783	3.2831	3.3060	3.3103	3.3307	3.3307	3.3345	3.3228	3.3103	3.3016	3.2925	
util living area	0.9930	0.9873	0.9739	0.9378	0.8585	0.7243	0.5840	0.6472	0.8518	0.9621	0.9885	0.9943	(86)
MIT	18.9027	19.1187	19.4977	20.0115	20.4806	20.8033	20.9304	20.9010	20.6289	20.0216	19.3715	18.8657	(87)
Th 2	19.9234	19.9254	19.9275	19.9369	19.9387	19.9470	19.9470	19.9485	19.9438	19.9387	19.9351	19.9314	(88)
util rest of house	0.9914	0.9845	0.9679	0.9222	0.8206	0.6473	0.4676	0.5332	0.7970	0.9499	0.9855	0.9930	(89)
MIT 2	18.0024	18.2186	18.5958	19.1054	19.5484	19.8314	19.9197	19.9060	19.6959	19.1241	18.4785	17.9712	(90)
Living area fraction	fLA = Living area / (4) =												0.2515 (91)
MIT	18.2288	18.4450	18.8226	19.3333	19.7828	20.0758	20.1739	20.1562	19.9305	19.3498	18.7031	18.1962	(92)
Temperature adjustment													0.0000
adjusted MIT	18.2288	18.4450	18.8226	19.3333	19.7828	20.0758	20.1739	20.1562	19.9305	19.3498	18.7031	18.1962	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	519.3996	607.1753	691.3756	761.8647	751.1688	604.8067	431.8669	440.8724	555.7911	556.7380	506.7838	489.5831	(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	1834.4584	1780.0814	1616.0298	1354.6933	1047.5357	703.4677	459.1335	481.7644	751.5783	1133.9736	1509.4686	1827.9878	(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	978.4038	788.1929	687.9427	426.8366	220.4970	0.0000	0.0000	0.0000	0.0000	429.4633	721.9331	995.7731	(98)
Space heating													5249.0423 (98)
Space heating per m2	(98) / (4) =												47.6579 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1207.5982	950.6624	974.7626	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7619	0.8303	0.7914	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	920.0721	789.3214	771.4562	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1185.3947	1128.9010	1033.9624	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	191.0323	252.6472	195.3047	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												638.9842	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	47.7581	63.1618	48.8262	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												159.7460	(107)
Space cooling per m2												1.4504	(108)
Energy for space heating												47.6579	(99)
Energy for space cooling												1.4504	(108)
Total												49.1083	(109)
Dwelling Fabric Energy Efficiency (DFEE)												49.1	(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	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (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) =	0.1516 (8)	
Pressure test															Yes		
Measured/design AP50															5.0000		
Infiltration rate															0.4016 (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) =					0.3414 (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	0.4353	0.4267	0.4182	0.3755	0.3670	0.3243	0.3243	0.3158	0.3414	0.3670	0.3841	0.4011 (22b)					
Effective ac	0.5947	0.5911	0.5874	0.5705	0.5673	0.5526	0.5526	0.5499	0.5583	0.5673	0.5738	0.5805 (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 Opaque door			2.1300	1.0000	2.1300		(26)					
TER Opening Type (Uw = 1.40)			18.9900	1.3258	25.1761		(27)					
Heat Loss Floor 1			55.0700	0.1300	7.1591		(28a)					
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.1800	21.8052		(29a)					
External Roof 1	55.0700		55.0700	0.1300	7.1591		(30)					
Total net area of external elements Aum(A, m2)			252.4000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	63.4295		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.0109 (36)					
Total fabric heat loss						(33) + (36) =	74.4404 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 51.7710	Feb 51.4507	Mar 51.1369	Apr 49.6626	May 49.3868	Jun 48.1027	Jul 48.1027	Aug 47.8649	Sep 48.5973	Oct 49.3868	Nov 49.9448	Dec 50.5281 (38)
Heat transfer coeff	126.2114	125.8912	125.5773	124.1030	123.8272	122.5432	122.5432	122.3054	123.0378	123.8272	124.3852	124.9686 (39)
Average = Sum(39)m / 12 =												124.1017 (39)
HLP	Jan 1.1459	Feb 1.1430	Mar 1.1402	Apr 1.1268	May 1.1243	Jun 1.1126	Jul 1.1126	Aug 1.1105	Sep 1.1171	Oct 1.1243	Nov 1.1293	Dec 1.1346 (40)
HLP (average)												1.1268 (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												2.8157 (42)
Average daily hot water use (litres/day)												101.0720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												
Energy content (annual)	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy content (annual)	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1590.2563 (45)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	35.0361	30.6428	31.6206	27.5676	26.4518	22.8259	21.1515	24.2717	24.5615	28.6241	31.2455	33.9306 (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	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	140.7832	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.9244	22.1376	18.0035	13.6298	10.1885	8.6015	9.2943	12.0810	16.2151	20.5888	24.0302	25.6171	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	271.7570	274.5770	267.4707	252.3423	233.2454	215.2970	203.3063	200.4863	207.5926	222.7210	241.8180	259.7664	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	37.0783	(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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	47.0915	45.5993	42.5008	38.2883	35.5534	31.7026	28.4295	32.6232	34.1133	38.4733	43.3965	45.6056	(72)
Total internal gains	409.0079	407.5489	393.2100	369.4954	344.2222	320.8360	306.2650	310.4255	323.1560	347.0181	374.4796	396.2240	(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					1.4400	11.2829	0.6300	0.7000	0.7700		4.9654 (75)	
Southeast					6.2400	36.7938	0.6300	0.7000	0.7700		70.1668 (77)	
Southwest					0.5700	36.7938	0.6300	0.7000	0.7700		6.4095 (79)	
Northwest					10.7400	11.2829	0.6300	0.7000	0.7700		37.0338 (81)	

Solar gains	118.5755	215.9283	332.4975	474.0901	587.7113	608.3977	576.1829	487.6041	380.9301	248.6378	144.5666	99.8320 (83)
Total gains	527.5833	623.4773	725.7075	843.5856	931.9335	929.2337	882.4479	798.0296	704.0861	595.6559	519.0462	496.0560 (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	60.6016	60.7557	60.9076	61.6311	61.7684	62.4156	62.4156	62.5370	62.1647	61.7684	61.4913	61.2043		
alpha	5.0401	5.0504	5.0605	5.1087	5.1179	5.1610	5.1610	5.1691	5.1443	5.1179	5.0994	5.0803		
util living area	0.9993	0.9982	0.9943	0.9763	0.9111	0.7594	0.5914	0.6664	0.9046	0.9895	0.9985	0.9995	(86)	
MIT	19.6513	19.8009	20.0609	20.4193	20.7408	20.9325	20.9851	20.9735	20.8181	20.4017	19.9637	19.6287	(87)	
Th 2	19.9635	19.9659	19.9682	19.9790	19.9811	19.9905	19.9905	19.9923	19.9869	19.9811	19.9769	19.9726	(88)	
util rest of house	0.9991	0.9976	0.9921	0.9664	0.8738	0.6706	0.4657	0.5389	0.8489	0.9838	0.9978	0.9993	(89)	
MIT 2	18.7263	18.8775	19.1384	19.4998	19.8002	19.9584	19.9866	19.9843	19.8783	19.4879	19.0493	18.7111	(90)	
Living area fraction									fLA = Living area / (4) =			0.2515	(91)	
MIT	18.9590	19.1098	19.3704	19.7310	20.0368	20.2034	20.2378	20.2331	20.1146	19.7177	19.2793	18.9419	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9590	19.1098	19.3704	19.7310	20.0368	20.2034	20.2378	20.2331	20.1146	19.7177	19.2793	18.9419	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9968	0.9903	0.9634	0.8762	0.6910	0.4977	0.5714	0.8574	0.9817	0.9972	0.9991	(94)
Useful gains	526.9068	621.4931	718.7001	812.7169	816.5303	642.1389	439.1826	455.9618	603.6497	584.7711	517.5958	495.5941	(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	1850.1272	1788.8830	1616.2332	1344.1657	1032.3169	686.6603	445.7820	468.8122	740.0265	1129.0208	1514.9244	1842.2698	(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	984.4760	784.4860	667.7646	382.6431	160.5453	0.0000	0.0000	0.0000	0.0000	404.9218	718.0766	1001.9267	(98)
Space heating												5104.8401	(98)
Space heating per m2											(98) / (4) =	46.3486	(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	1151.9057	906.8194	929.5209	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8532	0.9168	0.8821	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	982.8413	831.4028	819.9055	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1196.6823	1139.5908	1043.0089	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	153.9655	229.2919	165.9889	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												549.2463 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	38.4914	57.3230	41.4972	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												137.3116 (107)
Space cooling per m2												1.2467 (108)
Energy for space heating												46.3486 (99)
Energy for space cooling												1.2467 (108)
Total												47.5953 (109)
Target Fabric Energy Efficiency (TFEE)												54.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1516 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.3771 (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) =	0.3206 (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	0.3366	0.3126	0.3206	0.3045	0.3045	0.2965	0.2885	0.2805	0.2725	0.2965	0.2805	0.2965 (22b)
Effective ac	0.5566	0.5488	0.5514	0.5464	0.5464	0.5440	0.5416	0.5393	0.5371	0.5440	0.5393	0.5440 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			14.8900	1.3258	19.7405		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			55.0700	0.1500	8.2605	75.0000	4130.2500 (28a)
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.2500	30.2850	60.0000	7268.4000 (29a)
External Roof 1	55.0700		55.0700	0.1300	7.1591	9.0000	495.6300 (30)
Total net area of external elements Aum(A, m ²)			252.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7977		(33)
GF			45.6300			9.0000	410.6700 (32c)
GF			29.4300			39.0000	1147.7700 (32c)
FF			136.5500			9.0000	1228.9500 (32c)
Internal Floor 1			55.0700			18.0000	991.2600 (32d)
Internal Floor 1			55.0700			18.0000	991.2600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 16664.1900 (34)
151.3001 (35)
8.1089 (36)
(33) + (36) = 80.9067 (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	48.4558	47.7765	47.9973	47.5612	47.5612	47.3516	47.1475	46.9490	46.7561	47.3516	46.9490	47.3516 (38)
Heat transfer coeff	129.3624	128.6831	128.9040	128.4679	128.4679	128.2582	128.0542	127.8557	127.6628	128.2582	127.8557	128.2582 (39)
Average = Sum(39)m / 12 =												128.3407 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1745	1.1684	1.1704	1.1664	1.1664	1.1645	1.1626	1.1608	1.1591	1.1645	1.1608	1.1645 (40)
HLP (average)												1.1653 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8157 (42)
101.0720 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy conte	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1590.2563 (45)											
Distribution loss (46)m = 0.15 x (45)m	24.7313	21.6302	22.3204	19.4595	18.6718	16.1124	14.9305	17.1329	17.3376	20.2053	22.0556	23.9510 (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	21.0726	19.0130	21.0034	20.2592	20.8721	20.1269	20.7529	20.8302	20.1990	20.9428	20.3390	21.0502 (61)
Total heat required for water heating calculated for each month	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (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	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (64)
RHI water heating demand												1836.7176 (64)
Heat gains from water heating, kWh/month	60.0893	52.7002	54.7278	48.2000	46.6073	40.7475	38.2841	43.1856	43.4813	50.0240	53.9747	58.3539 (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	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.3110	55.3441	45.0089	34.0746	25.4712	21.5038	23.2356	30.2026	40.5378	51.4721	60.0755	64.0429 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096 (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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265 (71)
Water heating gains (Table 5)	80.7651	78.4228	73.5588	66.9444	62.6442	56.5937	51.4572	58.0451	60.3908	67.2366	74.9649	78.4326 (72)
Total internal gains	662.7066	657.6063	631.8006	591.6722	550.2657	513.4592	492.1580	501.5040	524.7912	565.1511	609.9856	644.2094 (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			1.4400		14.6176		0.6200		0.7000		0.7700		6.3309 (75)
Southeast			6.2400		45.1778		0.6200		0.7000		0.7700		84.7877 (77)
Southwest			0.5700		45.1778		0.6200		0.7000		0.7700		7.7450 (79)
Northwest			6.6400		14.6176		0.6200		0.7000		0.7700		29.1923 (81)
Northwest			4.1000		14.6176		0.6200		0.7000		0.7700		18.0254 (81)
Solar gains	146.0813	227.5008	355.7002	513.2916	605.9573	681.4423	640.3245	554.7635	431.5861	283.4007	177.7575	120.7519	(83)
Total gains	808.7879	885.1071	987.5009	1104.9638	1156.2230	1194.9015	1132.4825	1056.2674	956.3774	848.5518	787.7431	764.9613	(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	35.7827	35.9716	35.9100	36.0319	36.0319	36.0908	36.1483	36.2044	36.2591	36.0908	36.2044	36.0908
alpha	3.3855	3.3981	3.3940	3.4021	3.4021	3.4061	3.4099	3.4136	3.4173	3.4061	3.4136	3.4061
util living area	0.9747	0.9651	0.9370	0.8700	0.7503	0.5615	0.4255	0.4521	0.7026	0.8915	0.9582	0.9780 (86)
MIT	19.4059	19.5615	19.9159	20.3630	20.7229	20.9257	20.9783	20.9740	20.8363	20.4137	19.8627	19.3897 (87)
Th 2	19.9404	19.9454	19.9438	19.9470	19.9470	19.9485	19.9500	19.9515	19.9529	19.9485	19.9515	19.9485 (88)
util rest of house	0.9694	0.9578	0.9236	0.8414	0.6949	0.4744	0.3176	0.3391	0.6225	0.8604	0.9478	0.9732 (89)
MIT 2	17.8451	18.0721	18.5777	19.2016	19.6700	19.8954	19.9405	19.9399	19.8166	19.2860	18.5137	17.8274 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.2376	18.4467	18.9142	19.4937	19.9348	20.1545	20.2015	20.2000	20.0730	19.5696	18.8529	18.2204 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.0876	18.2967	18.7642	19.3437	19.7848	20.0045	20.0515	20.0500	19.9230	19.4196	18.7029	18.0704 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9563	0.9423	0.9041	0.8219	0.6854	0.4793	0.3284	0.3502	0.6199	0.8410	0.9310	0.9612 (94)
Ext temp.	773.4583	834.0568	892.7945	908.1935	792.4516	572.7413	371.9356	369.8812	592.9046	713.6362	733.4105	735.2895 (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	1705.9843	1672.4501	1516.4584	1264.5961	935.8637	603.3958	377.9529	377.1695	666.7868	1028.5849	1381.2179	1676.3803 (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)
RHI space heating demand	693.7993	563.4003	464.0059	256.6099	106.6985	0.0000	0.0000	0.0000	0.0000	234.3218	466.4214	700.1715 (98)
												3485.4288 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1516 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.3771 (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) =	0.3206 (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	0.4087	0.4007	0.3927	0.3526	0.3446	0.3045	0.3045	0.2965	0.3206	0.3446	0.3606	0.3767 (22b)
Effective ac	0.5835	0.5803	0.5771	0.5622	0.5594	0.5464	0.5464	0.5440	0.5514	0.5594	0.5650	0.5709 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			14.8900	1.3258	19.7405		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			55.0700	0.1500	8.2605	75.0000	4130.2500 (28a)
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.2500	30.2850	60.0000	7268.4000 (29a)
External Roof 1	55.0700		55.0700	0.1300	7.1591	9.0000	495.6300 (30)
Total net area of external elements Aum(A, m ²)			252.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7977		(33)
GF			45.6300			9.0000	410.6700 (32c)
GF			29.4300			39.0000	1147.7700 (32c)
FF			136.5500			9.0000	1228.9500 (32c)
Internal Floor 1			55.0700			18.0000	991.2600 (32d)
Internal Floor 1			55.0700			18.0000	991.2600 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 16664.1900 (34)
151.3001 (35)
8.1089 (36)
(33) + (36) = 80.9067 (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	50.7956	50.5132	50.2365	48.9366	48.6934	47.5612	47.5612	47.3516	47.9973	48.6934	49.1854	49.6998 (38)
Heat transfer coeff	131.7022	131.4199	131.1432	129.8433	129.6001	128.4679	128.4679	128.2582	128.9040	129.6001	130.0921	130.6064 (39)
Average = Sum(39)m / 12 =												129.8421 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1958	1.1932	1.1907	1.1789	1.1767	1.1664	1.1664	1.1645	1.1704	1.1767	1.1812	1.1858 (40)
HLP (average)												1.1789 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
Average daily hot water use (litres/day)
2.8157 (42)
101.0720 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy conte	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1590.2563 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7313	21.6302	22.3204	19.4595	18.6718	16.1124	14.9305	17.1329	17.3376	20.2053	22.0556	23.9510 (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	21.0726	19.0130	21.0034	20.2592	20.8721	20.1269	20.7529	20.8302	20.1990	20.9428	20.3390	21.0502 (61)	
Total heat required for water heating calculated for each month	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (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	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (64)	
	Total per year (kWh/year) = Sum(64)m =											1836.7176 (64)	
Heat gains from water heating, kWh/month	60.0893	52.7002	54.7278	48.2000	46.6073	40.7475	38.2841	43.1856	43.4813	50.0240	53.9747	58.3539 (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	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.3110	55.3441	45.0089	34.0746	25.4712	21.5038	23.2356	30.2026	40.5378	51.4721	60.0755	64.0429	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	80.7651	78.4228	73.5588	66.9444	62.6442	56.5937	51.4572	58.0451	60.3908	67.2366	74.9649	78.4326	(72)
Total internal gains	662.7066	657.6063	631.8006	591.6722	550.2657	513.4592	492.1580	501.5040	524.7912	565.1511	609.9856	644.2094	(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				1.4400	11.2829	0.6200	0.7000	0.7700	4.8866 (75)				
Southeast				6.2400	36.7938	0.6200	0.7000	0.7700	69.0530 (77)				
Southwest				0.5700	36.7938	0.6200	0.7000	0.7700	6.3077 (79)				
Northwest				6.6400	11.2829	0.6200	0.7000	0.7700	22.5327 (81)				
Northwest				4.1000	11.2829	0.6200	0.7000	0.7700	13.9133 (81)				
Solar gains	116.6933	212.5009	327.2197	466.5649	578.3825	598.7406	567.0371	479.8643	374.8836	244.6911	142.2719	98.2474	(83)
Total gains	779.3999	870.1072	959.0204	1058.2371	1128.6482	1112.1998	1059.1951	981.3683	899.6748	809.8422	752.2575	742.4568	(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	35.1470	35.2225	35.2969	35.6502	35.7171	36.0319	36.0319	36.0908	35.9100	35.7171	35.5820	35.4419
alpha	3.3431	3.3482	3.3531	3.3767	3.3811	3.4021	3.4021	3.4061	3.3940	3.3811	3.3721	3.3628
util living area	0.9797	0.9693	0.9474	0.8955	0.7964	0.6455	0.5023	0.5538	0.7680	0.9201	0.9690	0.9825 (86)
MIT	19.2414	19.4405	19.7822	20.2331	20.6228	20.8713	20.9590	20.9425	20.7553	20.2582	19.6730	19.2015 (87)
Th 2	19.9234	19.9254	19.9275	19.9369	19.9387	19.9470	19.9470	19.9485	19.9438	19.9387	19.9351	19.9314 (88)
util rest of house	0.9754	0.9630	0.9361	0.8721	0.7499	0.5655	0.3945	0.4450	0.6996	0.8973	0.9615	0.9789 (89)
MIT 2	17.5962	17.8850	18.3770	19.0178	19.5396	19.8423	19.9251	19.9151	19.7202	19.0668	18.2308	17.5433 (90)
Living area fraction	18.0099	18.2762	18.7304	19.3234	19.8120	20.1011	20.1851	20.1735	19.9805	19.3664	18.5935	17.9603 (91)
MIT	18.0099	18.2762	18.7304	19.3234	19.8120	20.1011	20.1851	20.1735	19.9805	19.3664	18.5935	17.9603 (92)
Temperature adjustment	17.8599	18.1262	18.5804	19.1734	19.6620	19.9511	20.0351	20.0235	19.8305	19.2164	18.4435	-0.1500
adjusted MIT	17.8599	18.1262	18.5804	19.1734	19.6620	19.9511	20.0351	20.0235	19.8305	19.2164	18.4435	17.8103 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9638	0.9482	0.9174	0.8515	0.7360	0.5659	0.4040	0.4533	0.6912	0.8772	0.9467	0.9684	(94)
Useful gains	751.1576	825.0450	879.7917	901.1215	830.6990	629.3656	427.9229	444.8262	621.8694	710.4134	712.1320	718.9859	(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	1785.8742	1738.1846	1584.2673	1333.9322	1031.8801	687.4395	441.2994	464.7484	738.6831	1116.6887	1475.7029	1777.5982	(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	769.8292	613.6298	524.1298	311.6237	149.6787	0.0000	0.0000	0.0000	0.0000	302.2688	549.7710	787.6075	(98)
Space heating												4008.5386	(99)
Space heating per m2											(98) / (4) =	36.3949	(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													4453.9318 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	769.8292	613.6298	524.1298	311.6237	149.6787	0.0000	0.0000	0.0000	0.0000	302.2688	549.7710	787.6075	(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)	855.3657	681.8109	582.3665	346.2485	166.3097	0.0000	0.0000	0.0000	0.0000	335.8542	610.8567	875.1195	(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	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234	(64)
Efficiency of water heater (217)m	89.3384	89.2860	89.1695	88.9005	88.3434	86.7000	86.7000	86.7000	86.7000	88.8505	89.2075	89.3652	(216)
Fuel for water heating, kWh/month	208.1390	182.7993	190.4308	168.7156	164.5296	147.1080	138.7422	155.7668	156.6122	175.1757	187.6259	202.2302	(219)
Water heating fuel used												2077.8753	(219)
Annual totals kWh/year													
Space heating fuel - main system												4453.9318	(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)												440.1730	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												6458.6905	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4453.9318	3.4800	154.9968 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2077.8753	3.4800	72.3101 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	440.1730	13.1900	58.0588 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-588.2895	13.1900	-77.5954 (252)
Total energy cost			337.6628 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	0.9141 (257)
SAP value	87.2479
SAP rating (Section 12)	87 (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	4453.9318	0.2160	962.0493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2077.8753	0.2160	448.8211 (264)
Space and water heating			1410.8703 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.1730	0.5190	228.4498 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1372.9228 (272)
CO2 emissions per m2			12.4700 (273)
EI value			88.1416
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8827 = 3.942$, stars = 4
Water heating environmental impact	$0.216 / 0.8827 = 0.2447$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1516 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.3771 (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) =	0.3206 (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	0.3366	0.3126	0.3206	0.3045	0.3045	0.2965	0.2885	0.2805	0.2725	0.2965	0.2805	0.2965 (22b)
Effective ac	0.5566	0.5488	0.5514	0.5464	0.5464	0.5440	0.5416	0.5393	0.5371	0.5440	0.5393	0.5440 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			14.8900	1.3258	19.7405		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			55.0700	0.1500	8.2605	75.0000	4130.2500 (28a)
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.2500	30.2850	60.0000	7268.4000 (29a)
External Roof 1	55.0700		55.0700	0.1300	7.1591	9.0000	495.6300 (30)
Total net area of external elements Aum(A, m ²)			252.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7977		(33)
GF			45.6300			9.0000	410.6700 (32c)
GF			29.4300			39.0000	1147.7700 (32c)
FF			136.5500			9.0000	1228.9500 (32c)
Internal Floor 1			55.0700			18.0000	991.2600 (32d)
Internal Floor 1			55.0700			18.0000	991.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16664.1900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.3001 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1089 (36)
Total fabric heat loss							(33) + (36) = 80.9067 (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	48.4558	47.7765	47.9973	47.5612	47.5612	47.3516	47.1475	46.9490	46.7561	47.3516	46.9490	47.3516 (38)
Heat transfer coeff	129.3624	128.6831	128.9040	128.4679	128.4679	128.2582	128.0542	127.8557	127.6628	128.2582	127.8557	128.2582 (39)
Average = Sum(39)m / 12 =												128.3407 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1745	1.1684	1.1704	1.1664	1.1664	1.1645	1.1626	1.1608	1.1591	1.1645	1.1608	1.1645 (40)
HLP (average)												1.1653 (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												2.8157 (42)
Average daily hot water use (litres/day)												101.0720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy conte	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum(45)m = 1590.2563 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	24.7313	21.6302	22.3204	19.4595	18.6718	16.1124	14.9305	17.1329	17.3376	20.2053	22.0556	23.9510 (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	21.0726	19.0130	21.0034	20.2592	20.8721	20.1269	20.7529	20.8302	20.1990	20.9428	20.3390	21.0502 (61)
Total heat required for water heating calculated for each month	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (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	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (64)
	Total per year (kWh/year) = Sum(64)m =											1836.7176 (64)
Heat gains from water heating, kWh/month	60.0893	52.7002	54.7278	48.2000	46.6073	40.7475	38.2841	43.1856	43.4813	50.0240	53.9747	58.3539 (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	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.3110	55.3441	45.0089	34.0746	25.4712	21.5038	23.2356	30.2026	40.5378	51.4721	60.0755	64.0429	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	80.7651	78.4228	73.5588	66.9444	62.6442	56.5937	51.4572	58.0451	60.3908	67.2366	74.9649	78.4326	(72)
Total internal gains	662.7066	657.6063	631.8006	591.6722	550.2657	513.4592	492.1580	501.5040	524.7912	565.1511	609.9856	644.2094	(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					1.4400	14.6176	0.6200	0.7000	0.7700		6.3309 (75)	
Southeast					6.2400	45.1778	0.6200	0.7000	0.7700		84.7877 (77)	
Southwest					0.5700	45.1778	0.6200	0.7000	0.7700		7.7450 (79)	
Northwest					6.6400	14.6176	0.6200	0.7000	0.7700		29.1923 (81)	
Northwest					4.1000	14.6176	0.6200	0.7000	0.7700		18.0254 (81)	
Solar gains	146.0813	227.5008	355.7002	513.2916	605.9573	681.4423	640.3245	554.7635	431.5861	283.4007	177.7575	120.7519 (83)
Total gains	808.7879	885.1071	987.5009	1104.9638	1156.2230	1194.9015	1132.4825	1056.2674	956.3774	848.5518	787.7431	764.9613 (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	35.7827	35.9716	35.9100	36.0319	36.0319	36.0908	36.1483	36.2044	36.2591	36.0908	36.2044	36.0908	
alpha	3.3855	3.3981	3.3940	3.4021	3.4021	3.4061	3.4099	3.4136	3.4173	3.4061	3.4136	3.4061	
util living area	0.9747	0.9651	0.9370	0.8700	0.7503	0.5615	0.4255	0.4521	0.7026	0.8915	0.9582	0.9780	(86)
MIT	19.4059	19.5615	19.9159	20.3630	20.7229	20.9257	20.9783	20.9740	20.8363	20.4137	19.8627	19.3897	(87)
Th 2	19.9404	19.9454	19.9438	19.9470	19.9470	19.9485	19.9500	19.9515	19.9529	19.9485	19.9515	19.9485	(88)
util rest of house	0.9694	0.9578	0.9236	0.8414	0.6949	0.4744	0.3176	0.3391	0.6225	0.8604	0.9478	0.9732	(89)
MIT 2	17.8451	18.0721	18.5777	19.2016	19.6700	19.8954	19.9405	19.9399	19.8166	19.2860	18.5137	17.8274	(90)
Living area fraction	18.2376	18.4467	18.9142	19.4937	19.9348	20.1545	20.2015	20.2000	fLA = Living area / (4) =	19.5696	18.8529	0.2515	(91)
MIT	18.2376	18.4467	18.9142	19.4937	19.9348	20.1545	20.2015	20.2000	20.0730	19.5696	18.8529	18.2204	(92)
Temperature adjustment	18.0876	18.2967	18.7642	19.3437	19.7848	20.0045	20.0515	20.0500	19.9230	19.4196	18.7029	-0.1500	
adjusted MIT	18.0876	18.2967	18.7642	19.3437	19.7848	20.0045	20.0515	20.0500	19.9230	19.4196	18.7029	18.0704	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9563	0.9423	0.9041	0.8219	0.6854	0.4793	0.3284	0.3502	0.6199	0.8410	0.9310	0.9612	(94)
Ext temp.	773.4583	834.0568	892.7945	908.1935	792.4516	572.7413	371.9356	369.8812	592.9046	713.6362	733.4105	735.2895	(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	1705.9843	1672.4501	1516.4584	1264.5961	935.8637	603.3958	377.9529	377.1695	666.7868	1028.5849	1381.2179	1676.3803	(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	693.7993	563.4003	464.0059	256.6099	106.6985	0.0000	0.0000	0.0000	0.0000	234.3218	466.4214	700.1715	(98)
Space heating per m2												3485.4288	(98)
	(98) / (4) =												31.6454 (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												3872.6986	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	693.7993	563.4003	464.0059	256.6099	106.6985	0.0000	0.0000	0.0000	0.0000	234.3218	466.4214	700.1715	(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)	770.8881	626.0004	515.5621	285.1221	118.5539	0.0000	0.0000	0.0000	0.0000	260.3576	518.2460	777.9684	(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	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234	(64)
Efficiency of water heater	89.2817	89.2371	89.0915	88.7538	88.0670	86.7000	86.7000	86.7000	86.7000	88.6532	89.1044	86.7000	(216)
(217)m												89.3027	(217)
Fuel for water heating, kWh/month	208.2712	182.8996	190.5975	168.9945	165.0460	147.1080	138.7422	155.7668	156.6122	175.5656	187.8432	202.3718	(219)
Water heating fuel used												2079.8184	(219)
Annual totals kWh/year													
Space heating fuel - main system												3872.6986	(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)												440.1730	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												5799.5908	(238)

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3872.6986	3.9200	151.8098 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2079.8184	3.9200	81.5289 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	440.1730	16.9600	74.6533 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-668.0993	16.9600	-113.3096 (252)
Total energy cost			295.4024 (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	3872.6986	0.2160	836.5029 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2079.8184	0.2160	449.2408 (264)
Space and water heating			1285.7437 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	440.1730	0.5190	228.4498 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			1206.3749 (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	3872.6986	1.2200	4724.6923 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2079.8184	1.2200	2537.3785 (264)
Space and water heating			7262.0708 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	440.1730	3.0700	1351.3311 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			6792.5871 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

61.6723 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 88

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 32	-199 kg (16.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32	1.81 kg/m ²	B 88 B 90
Total Savings	£32	1.81 kg/m ²	

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 90

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£87	£96	-£8
Mains gas	£321	£281	£41
Space heating	£253	£253	£0
Water heating	£82	£49	£32
Lighting	£75	£75	£0
Generated (PV)	-£113	-£113	£0
Total cost of fuels	£295	£264	£33
Total cost of uses	£297	£264	£32
Delivered energy	53 kWh/m ²	44 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	1.2 tonnes	1.0 tonnes	0.2 tonnes
CO2 emissions per m ²	11 kg/m ²	9 kg/m ²	2 kg/m ²
Primary energy	62 kWh/m ²	52 kWh/m ²	10 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1516 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.3771 (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) =	0.3206 (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	0.4087	0.4007	0.3927	0.3526	0.3446	0.3045	0.3045	0.2965	0.3206	0.3446	0.3606	0.3767 (22b)
Effective ac	0.5835	0.5803	0.5771	0.5622	0.5594	0.5464	0.5464	0.5440	0.5514	0.5594	0.5650	0.5709 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			14.8900	1.3258	19.7405		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			55.0700	0.1500	8.2605	75.0000	4130.2500 (28a)
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.2500	30.2850	60.0000	7268.4000 (29a)
External Roof 1	55.0700		55.0700	0.1300	7.1591	9.0000	495.6300 (30)
Total net area of external elements Aum(A, m ²)			252.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7977		(33)
GF			45.6300			9.0000	410.6700 (32c)
GF			29.4300			39.0000	1147.7700 (32c)
FF			136.5500			9.0000	1228.9500 (32c)
Internal Floor 1			55.0700			18.0000	991.2600 (32d)
Internal Floor 1			55.0700			18.0000	991.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16664.1900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.3001 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1089 (36)
Total fabric heat loss							(33) + (36) = 80.9067 (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	50.7956	50.5132	50.2365	48.9366	48.6934	47.5612	47.5612	47.3516	47.9973	48.6934	49.1854	49.6998 (38)
Heat transfer coeff	131.7022	131.4199	131.1432	129.8433	129.6001	128.4679	128.4679	128.2582	128.9040	129.6001	130.0921	130.6064 (39)
Average = Sum(39)m / 12 =												129.8421 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1958	1.1932	1.1907	1.1789	1.1767	1.1664	1.1664	1.1645	1.1704	1.1767	1.1812	1.1858 (40)
HLP (average)												1.1789 (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												2.8157 (42)
Average daily hot water use (litres/day)												101.0720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy conte	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1590.2563 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	24.7313	21.6302	22.3204	19.4595	18.6718	16.1124	14.9305	17.1329	17.3376	20.2053	22.0556	23.9510 (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	21.0726	19.0130	21.0034	20.2592	20.8721	20.1269	20.7529	20.8302	20.1990	20.9428	20.3390	21.0502 (61)
Total heat required for water heating calculated for each month	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (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												1.1404 (H8)
Utilisation factor												0.5839 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.0720 (H14)
Volume ratio Veff/V												0.7420 (H15)
Solar storage volume factor												0.9403 (H16)
Solar input												-875.5908 (H17)
Solar input	-25.3904	-42.3693	-72.1597	-96.7082	-119.4748	-117.4628	-115.9105	-101.2716	-79.3160	-54.1635	-30.1167	-21.2474 (63)
	Solar input (sum of months) = Sum (63)m =											-875.5908 (63)
Output from w/h	160.5577	120.8449	97.6465	53.2809	25.8761	10.0798	4.3790	33.7783	56.4668	101.4811	137.2598	159.4759 (64)
	Total per year (kWh/year) = Sum (64)m =											961.1268 (64)
Heat gains from water heating, kWh/month	60.0893	52.7002	54.7278	48.2000	46.6073	40.7475	38.2841	43.1856	43.4813	50.0240	53.9747	58.3539 (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	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.3110	55.3441	45.0089	34.0746	25.4712	21.5038	23.2356	30.2026	40.5378	51.4721	60.0755	64.0429	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	80.7651	78.4228	73.5588	66.9444	62.6442	56.5937	51.4572	58.0451	60.3908	67.2366	74.9649	78.4326	(72)
Total internal gains	662.7066	657.6063	631.8006	591.6722	550.2657	513.4592	492.1580	501.5040	524.7912	565.1511	609.9856	644.2094	(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					1.4400	11.2829		0.6200	0.7000	0.7700		4.8866 (75)	
Southeast					6.2400	36.7938		0.6200	0.7000	0.7700		69.0530 (77)	
Southwest					0.5700	36.7938		0.6200	0.7000	0.7700		6.3077 (79)	
Northwest					6.6400	11.2829		0.6200	0.7000	0.7700		22.5327 (81)	
Northwest					4.1000	11.2829		0.6200	0.7000	0.7700		13.9133 (81)	
Solar gains	116.6933	212.5009	327.2197	466.5649	578.3825	598.7406	567.0371	479.8643	374.8836	244.6911	142.2719	98.2474 (83)	
Total gains	779.3999	870.1072	959.0204	1058.2371	1128.6482	1112.1998	1059.1951	981.3683	899.6748	809.8422	752.2575	742.4568 (84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	35.1470	35.2225	35.2969	35.6502	35.7171	36.0319	36.0319	36.0908	35.9100	35.7171	35.5820	35.4419	
alpha	3.3431	3.3482	3.3531	3.3767	3.3811	3.4021	3.4021	3.4061	3.3940	3.3811	3.3721	3.3628	
util living area	0.9797	0.9693	0.9474	0.8955	0.7964	0.6455	0.5023	0.5538	0.7680	0.9201	0.9690	0.9825	(86)
MIT	19.2414	19.4405	19.7822	20.2331	20.6228	20.8713	20.9590	20.9425	20.7553	20.2582	19.6730	19.2015	(87)
Th 2	19.9234	19.9254	19.9275	19.9369	19.9387	19.9470	19.9470	19.9485	19.9438	19.9387	19.9351	19.9314	(88)
util rest of house	0.9754	0.9630	0.9361	0.8721	0.7499	0.5655	0.3945	0.4450	0.6996	0.8973	0.9615	0.9789	(89)
MIT 2	17.5962	17.8850	18.3770	19.0178	19.5396	19.8423	19.9251	19.9151	19.7202	19.0668	18.2308	17.5433	(90)
Living area fraction	18.0099	18.2762	18.7304	19.3234	19.8120	20.1011	20.1851	20.1735	19.9805	19.3664	18.5935	17.9603	(92)
Temperature adjustment	17.8599	18.1262	18.5804	19.1734	19.6620	19.9511	20.0351	20.0235	19.8305	19.2164	18.4435	17.8103	(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	0.9638	0.9482	0.9174	0.8515	0.7360	0.5659	0.4040	0.4533	0.6912	0.8772	0.9467	0.9684	(94)
Useful gains	751.1576	825.0450	879.7917	901.1215	830.6990	629.3656	427.9229	444.8262	621.8694	710.4134	712.1320	718.9859	(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	1785.8742	1738.1846	1584.2673	1333.9322	1031.8801	687.4395	441.2994	464.7484	738.6831	1116.6887	1475.7029	1777.5982	(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	769.8292	613.6298	524.1298	311.6237	149.6787	0.0000	0.0000	0.0000	0.0000	302.2688	549.7710	787.6075	(98)
Space heating												4008.5386	(98)
Space heating per m2												(98) / (4) =	36.3949 (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													4453.9318 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	769.8292	613.6298	524.1298	311.6237	149.6787	0.0000	0.0000	0.0000	0.0000	302.2688	549.7710	787.6075	(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)	855.3657	681.8109	582.3665	346.2485	166.3097	0.0000	0.0000	0.0000	0.0000	335.8542	610.8567	875.1195	(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	160.5577	120.8449	97.6465	53.2809	25.8761	10.0798	4.3790	33.7783	56.4668	101.4811	137.2598	159.4759	(64)
Efficiency of water heater	89.4127	89.4399	89.4652	89.5026	89.4979	86.7000	86.7000	86.7000	86.7000	89.1471	89.3208	89.4268	(216)
Fuel for water heating, kWh/month	179.5693	135.1130	109.1446	59.5300	28.9126	11.6261	5.0507	38.9599	65.1290	113.8355	153.6706	178.3312	(219)
Water heating fuel used												1078.8725	(219)
Annual totals kWh/year													
Space heating fuel - main system												4453.9318	(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)													440.1730 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												5509.6877	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4453.9318	3.4800	154.9968	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1078.8725	3.4800	37.5448	(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	440.1730	13.1900	58.0588	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			309.4925	(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] =	0.8379 (257)
SAP value		88.3117
SAP rating (Section 12)		88 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4453.9318	0.2160	962.0493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1078.8725	0.2160	233.0365 (264)
Space and water heating			1195.0857 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	440.1730	0.5190	228.4498 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			1183.0882 (272)
CO2 emissions per m2			10.7400 (273)
EI value			89.7812
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	55.0700 (1b)	x 2.3100 (2b)	= 127.2117 (1b) - (3b)
First floor	55.0700 (1c)	x 2.4800 (2c)	= 136.5736 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	110.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 263.7853 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1516 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.3771 (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) =	0.3206 (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	0.3366	0.3126	0.3206	0.3045	0.3045	0.2965	0.2885	0.2805	0.2725	0.2965	0.2805	0.2965 (22b)
Effective ac	0.5566	0.5488	0.5514	0.5464	0.5464	0.5440	0.5416	0.5393	0.5371	0.5440	0.5393	0.5440 (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
Solid Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			14.8900	1.3258	19.7405		(27)
French (Uw = 1.40)			4.1000	1.3258	5.4356		(27)
Heat Loss Floor 1			55.0700	0.1500	8.2605	75.0000	4130.2500 (28a)
100mm Knauf Supafil	142.2600	21.1200	121.1400	0.2500	30.2850	60.0000	7268.4000 (29a)
External Roof 1	55.0700		55.0700	0.1300	7.1591	9.0000	495.6300 (30)
Total net area of external elements Aum(A, m ²)			252.4000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		72.7977		(33)
GF			45.6300			9.0000	410.6700 (32c)
GF			29.4300			39.0000	1147.7700 (32c)
FF			136.5500			9.0000	1228.9500 (32c)
Internal Floor 1			55.0700			18.0000	991.2600 (32d)
Internal Floor 1			55.0700			18.0000	991.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16664.1900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.3001 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1089 (36)
Total fabric heat loss							(33) + (36) = 80.9067 (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	48.4558	47.7765	47.9973	47.5612	47.5612	47.3516	47.1475	46.9490	46.7561	47.3516	46.9490	47.3516 (38)
Heat transfer coeff	129.3624	128.6831	128.9040	128.4679	128.4679	128.2582	128.0542	127.8557	127.6628	128.2582	127.8557	128.2582 (39)
Average = Sum(39)m / 12 =												128.3407 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1745	1.1684	1.1704	1.1664	1.1664	1.1645	1.1626	1.1608	1.1591	1.1645	1.1608	1.1645 (40)
HLP (average)												1.1653 (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												2.8157 (42)
Average daily hot water use (litres/day)												101.0720 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.1792	107.1363	103.0935	99.0506	95.0077	90.9648	90.9648	95.0077	99.0506	103.0935	107.1363	111.1792 (44)
Energy conte	164.8756	144.2012	148.8027	129.7298	124.4789	107.4158	99.5365	114.2196	115.5838	134.7017	147.0375	159.6732 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy content (annual)	Total = Sum (45)m = 1590.2563 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	24.7313	21.6302	22.3204	19.4595	18.6718	16.1124	14.9305	17.1329	17.3376	20.2053	22.0556	23.9510 (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	21.0726	19.0130	21.0034	20.2592	20.8721	20.1269	20.7529	20.8302	20.1990	20.9428	20.3390	21.0502 (61)
Total heat required for water heating calculated for each month	185.9481	163.2142	169.8062	149.9891	145.3510	127.5427	120.2895	135.0498	135.7828	155.6445	167.3764	180.7234 (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												1.2763 (H8)
Utilisation factor												0.5432 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.0720 (H14)
Volume ratio Veff/V												0.7420 (H15)
Solar storage volume factor												0.9403 (H16)
Solar input												-911.5904 (H17)
Solar input	-29.7383	-42.2859	-72.6794	-98.0613	-115.1789	-123.0293	-120.4419	-107.7992	-84.3993	-58.3508	-35.1726	-24.4535 (63)
												Solar input (sum of months) = Sum (63)m = -911.5904 (63)
Output from w/h	156.2098	120.9283	97.1268	51.9278	30.1721	4.5134	0.0000	27.2506	51.3834	97.2937	132.2039	156.2698 (64)
												Total per year (kWh/year) = Sum (64)m = 925.2796 (64)
Heat gains from water heating, kWh/month	60.0893	52.7002	54.7278	48.2000	46.6073	40.7475	38.2841	43.1856	43.4813	50.0240	53.9747	58.3539 (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	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	168.9398	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	62.3110	55.3441	45.0089	34.0746	25.4712	21.5038	23.2356	30.2026	40.5378	51.4721	60.0755	64.0429	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	405.6075	409.8164	399.2100	376.6303	348.1274	321.3388	303.4423	299.2334	309.8397	332.4195	360.9223	387.7110	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	54.7096	(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)	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	-112.6265	(71)
Water heating gains (Table 5)	80.7651	78.4228	73.5588	66.9444	62.6442	56.5937	51.4572	58.0451	60.3908	67.2366	74.9649	78.4326	(72)
Total internal gains	662.7066	657.6063	631.8006	591.6722	550.2657	513.4592	492.1580	501.5040	524.7912	565.1511	609.9856	644.2094	(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					1.4400	14.6176		0.6200	0.7000	0.7700	6.3309 (75)					
Southeast					6.2400	45.1778		0.6200	0.7000	0.7700	84.7877 (77)					
Southwest					0.5700	45.1778		0.6200	0.7000	0.7700	7.7450 (79)					
Northwest					6.6400	14.6176		0.6200	0.7000	0.7700	29.1923 (81)					
Northwest					4.1000	14.6176		0.6200	0.7000	0.7700	18.0254 (81)					

Solar gains					146.0813	227.5008	355.7002	513.2916	605.9573	681.4423	640.3245	554.7635	431.5861	283.4007	177.7575	120.7519 (83)
Total gains					808.7879	885.1071	987.5009	1104.9638	1156.2230	1194.9015	1132.4825	1056.2674	956.3774	848.5518	787.7431	764.9613 (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	35.7827	35.9716	35.9100	36.0319	36.0319	36.0908	36.1483	36.2044	36.2591	36.0908	36.2044	36.0908
alpha	3.3855	3.3981	3.3940	3.4021	3.4021	3.4061	3.4099	3.4136	3.4173	3.4061	3.4136	3.4061
util living area	0.9747	0.9651	0.9370	0.8700	0.7503	0.5615	0.4255	0.4521	0.7026	0.8915	0.9582	0.9780 (86)
MIT	19.4059	19.5615	19.9159	20.3630	20.7229	20.9257	20.9783	20.9740	20.8363	20.4137	19.8627	19.3897 (87)
Th 2	19.9404	19.9454	19.9438	19.9470	19.9470	19.9485	19.9500	19.9515	19.9529	19.9485	19.9515	19.9485 (88)
util rest of house	0.9694	0.9578	0.9236	0.8414	0.6949	0.4744	0.3176	0.3391	0.6225	0.8604	0.9478	0.9732 (89)
MIT 2	17.8451	18.0721	18.5777	19.2016	19.6700	19.8954	19.9405	19.9399	19.8166	19.2860	18.5137	17.8274 (90)
Living area fraction	18.2376	18.4467	18.9142	19.4937	19.9348	20.1545	20.2015	20.2000	20.0730	19.5696	18.8529	18.2204 (92)
MIT	18.2376	18.4467	18.9142	19.4937	19.9348	20.1545	20.2015	20.2000	20.0730	19.5696	18.8529	18.2204 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0876	18.2967	18.7642	19.3437	19.7848	20.0045	20.0515	20.0500	19.9230	19.4196	18.7029	18.0704 (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	0.9563	0.9423	0.9041	0.8219	0.6854	0.4793	0.3284	0.3502	0.6199	0.8410	0.9310	0.9612	(94)
Useful gains	773.4583	834.0568	892.7945	908.1935	792.4516	572.7413	371.9356	369.8812	592.9046	713.6362	733.4105	735.2895	(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	1705.9843	1672.4501	1516.4584	1264.5961	935.8637	603.3958	377.9529	377.1695	666.7868	1028.5849	1381.2179	1676.3803	(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	693.7993	563.4003	464.0059	256.6099	106.6985	0.0000	0.0000	0.0000	0.0000	234.3218	466.4214	700.1715	(98)
Space heating												3485.4288	(98)
Space heating per m2											(98) / (4) =	31.6454	(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													3872.6986	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	693.7993	563.4003	464.0059	256.6099	106.6985	0.0000	0.0000	0.0000	0.0000	234.3218	466.4214	700.1715	(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)	770.8881	626.0004	515.5621	285.1221	118.5539	0.0000	0.0000	0.0000	0.0000	260.3576	518.2460	777.9684	(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	156.2098	120.9283	97.1268	51.9278	30.1721	4.5134	0.0000	27.2506	51.3834	97.2937	132.2039	156.2698	(64)	
Efficiency of water heater	89.3748	89.3987	89.4109	89.4271	89.2511	86.7000	86.7000	86.7000	86.7000	89.0061	89.2498	89.3793	(216)	
Fuel for water heating, kWh/month	174.7806	135.2685	108.6297	58.0671	33.8058	5.2057	0.0000	31.4310	59.2658	109.3114	148.1280	174.8390	(219)	
Water heating fuel used												1038.7325	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3872.6986	(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)													440.1730	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)	
Total delivered energy for all uses												4808.5048	(238)	

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3872.6986	3.9200	151.8098	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1038.7325	3.9200	40.7183	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	440.1730	16.9600	74.6533	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	16.9600	-113.3096	(252)
Total energy cost			263.0718	(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	3872.6986	0.2160	836.5029	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1038.7325	0.2160	224.3662	(264)
Space and water heating			1060.8691	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	440.1730	0.5190	228.4498	(268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			1007.4504 (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	3872.6986	1.2200	4724.6923 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1038.7325	1.2200	1267.2537 (264)
Space and water heating			5991.9460 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	440.1730	3.0700	1351.3311 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			5675.9622 (272)
Primary energy kWh/m2/year			51.5341 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	South East
Overshading	Average or unknown
Thermal mass parameter	151.3 (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	348.20 (P1)
Transmission heat loss coefficient	80.91 (37)
Summer heat loss coefficient	429.10 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	1.4400	106.0502	0.6200	0.7000	0.9000	53.6845
South East	6.2400	127.3119	0.6200	0.7000	0.9000	279.2725
South West	0.5700	127.3119	0.6200	0.7000	0.9000	25.5105
North West	6.6400	106.0502	0.6200	0.7000	0.9000	247.5451
North West	4.1000	106.0502	0.6200	0.7000	0.9000	152.8517

total: 758.8643

	Jun	Jul	Aug	
Solar gains	821	759	655	(P3)
Internal gains	510	489	499	
Total summer gains	1331	1248	1154	(P5)

Summer gain/loss ratio	3.10	2.91	2.69	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 151.3)	0.94	0.94	0.94	
Threshold temperature	19.44	21.15	20.93	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight