

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-171				Issued on Date	26/04/2019
Assessment Reference	As Built		Prop Type Ref	2302 - Mid (As)		
Property	57, St Andrews Road, Botley, SOUTHAMPTON, SO32 2ST					
SAP Rating	87 B	DER	13.83	TER	17.16	
Environmental	90 B	% DER<TER	19.39			
CO ₂ Emissions (t/year)	0.82	DFEE	40.14	TFEE	44.63	
General Requirements Compliance	Pass	% DFEE<TFEE	10.06			
Assessor Details	Mr. Silvio Junges, Silvio Junges, Tel: 01884 242050, silvio.junges@aessouthern.co.uk				Assessor ID	P637-0001
Client						

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

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DWELLING AS BUILT

Mid-Terrace House, total floor area 78 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) 17.16 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.83 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 40.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.33 (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: 4.47 (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 East: 8.00 m², No overhang
Windows facing West: 4.46 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Photovoltaic array 0.54 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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4700
Infiltration rate					0.3846 (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) =	0.3269 (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	0.4168	0.4087	0.4005	0.3596	0.3515	0.3106	0.3106	0.3024	0.3269	0.3515	0.3678	0.3842 (22b)
Effective ac	0.5869	0.5835	0.5802	0.5647	0.5618	0.5482	0.5482	0.5457	0.5534	0.5618	0.5676	0.5738 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (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) = 16447.4600 (34)
211.1356 (35)
7.8202 (36)
(33) + (36) = 45.1462 (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	36.0578	35.8505	35.6473	34.6930	34.5145	33.6833	33.6833	33.5294	34.0035	34.5145	34.8757	35.2533 (38)
Heat transfer coeff	81.2040	80.9967	80.7935	79.8392	79.6607	78.8295	78.8295	78.6756	79.1496	79.6607	80.0219	80.3995 (39)
Average = Sum(39)m / 12 =												79.8383 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0424	1.0398	1.0371	1.0249	1.0226	1.0119	1.0119	1.0100	1.0160	1.0226	1.0272	1.0321 (40)
HLP (average)												1.0249 (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)
2.4218 (42)
91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)

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Energy content (annual)	Total = Sum(45)m = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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 (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 (57)
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938 (64)
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314 (65)
Total per year (kWh/year) = Sum(64)m =	1688.5811 (64)										

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9978	17.7619	14.4449	10.9358	8.1746	6.9013	7.4571	9.6931	13.0100	16.5192	19.2804	20.5536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	371.2443	369.1080	355.7484	334.2649	312.4950	291.5338	277.9435	283.9246	294.9909	316.6839	341.5721	360.1973	(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
East			2.2000			19.6403	0.6200		0.7000		0.7700	12.9955 (76)
West			4.4600			19.6403	0.6200		0.7000		0.7700	26.3454 (80)
East			5.8000			19.6403	0.6200		0.7000		0.7700	34.2609 (76)
Solar gains	73.6018	143.9807	237.1157	345.8191	423.8143	433.8494	413.0423	354.7972	275.7754	170.8452	91.7728	60.5265 (83)
Total gains	444.8461	513.0887	592.8641	680.0840	736.3093	725.3832	690.9858	638.7218	570.7662	487.5291	433.3448	420.7238 (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	56.2625	56.4065	56.5483	57.2243	57.3525	57.9572	57.9572	58.0706	57.7228	57.3525	57.0936	56.8255
alpha	4.7508	4.7604	4.7699	4.8150	4.8235	4.8638	4.8638	4.8714	4.8482	4.8235	4.8062	4.7884
util living area	0.9966	0.9928	0.9804	0.9372	0.8308	0.6544	0.4931	0.5506	0.8102	0.9666	0.9934	0.9974 (86)
MIT	19.7167	19.8822	20.1692	20.5362	20.8177	20.9578	20.9913	20.9855	20.8817	20.4956	20.0383	19.6881 (87)
Th 2	20.0481	20.0503	20.0525	20.0626	20.0645	20.0734	20.0734	20.0750	20.0700	20.0645	20.0607	20.0567 (88)
util rest of house	0.9957	0.9908	0.9747	0.9187	0.7845	0.5746	0.3936	0.4474	0.7426	0.9532	0.9912	0.9967 (89)
MIT 2	18.3269	18.5694	18.9865	19.5119	19.8811	20.0430	20.0696	20.0681	19.9692	19.4664	18.8054	18.2911 (90)
Living area fraction	18.8643	19.0770	19.4438	19.9080	20.2432	20.3967	20.4260	20.4228	20.3220	19.8643	19.2821	18.8312 (91)
MIT	18.8643	19.0770	19.4438	19.9080	20.2432	20.3967	20.4260	20.4228	20.3220	19.8643	19.2821	18.8312 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7143	18.9270	19.2938	19.7580	20.0932	20.2467	20.2760	20.2728	20.1720	19.7143	19.1321	18.6812 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	442.0527	506.6280	574.2776	619.8463	578.7765	428.1662	287.3027	300.3089	428.5825	461.5151	428.1573	418.6646	(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	1170.4949	1136.1391	1033.6565	866.8914	668.6112	445.1274	289.7744	304.6954	480.5968	726.0545	962.8331	1164.2838	(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	541.9610	423.0314	341.7779	177.8724	66.8370	0.0000	0.0000	0.0000	0.0000	196.8173	384.9666	554.7407	(98)
Space heating												2688.0045	(98)
Space heating per m2												34.5058	(99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2986.6716	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	541.9610	423.0314	341.7779	177.8724	66.8370	0.0000	0.0000	0.0000	0.0000	196.8173	384.9666	554.7407	(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)	602.1789	470.0349	379.7532	197.6360	74.2633	0.0000	0.0000	0.0000	0.0000	218.6859	427.7407	616.3785	(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	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)	
Efficiency of water heater (217)m	89.1872	89.1130	88.9394	88.5286	87.7724	86.7000	86.7000	86.7000	86.7000	88.5807	89.0331	89.2183	(216)	
Fuel for water heating, kWh/month	191.3094	168.0961	175.3307	155.7522	152.3723	135.5563	128.0378	143.4793	144.1738	161.5370	172.6255	185.9285	(219)	
Water heating fuel used												1914.1990	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2986.6716	(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)													353.1679	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930			-392.1930	(233)
Total delivered energy for all uses													4936.8455	(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	2986.6716	0.2160	645.1211	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.1990	0.2160	413.4670	(264)
Space and water heating			1058.5881	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	353.1679	0.5190	183.2942	(268)
Energy saving/generation technologies				
PV Unit	-392.1930	0.5190	-203.5482	(269)
Total CO2, kg/year			1077.2590	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8300	(273)

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

DER			13.8300	ZC1
Total Floor Area		TFA	77.9000	
Assumed number of occupants		N	2.4218	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.3545	ZC2
CO2 emissions from cooking, equation (L16)			2.2737	ZC3
Total CO2 emissions			32.4583	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			32.4583	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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (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																3 * 10 =	30.0000 (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) =					30.0000	/ (5) =	0.1611 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4111 (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) =					0.3495 (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	0.4456	0.4368	0.4281	0.3844	0.3757	0.3320	0.3320	0.3233	0.3495	0.3757	0.3931	0.4106	(22b)				
Effective ac	0.5993	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5522	0.5611	0.5706	0.5773	0.5843	(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			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			12.4600	1.3258	16.5189		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.1800	5.5782		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			123.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		34.1841		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3737 (36)					
Total fabric heat loss						(33) + (36) =	42.5578 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.8186	Feb 36.5818	Mar 36.3497	Apr 35.2594	May 35.0554	Jun 34.1057	Jul 34.1057	Aug 33.9299	Sep 34.4715	Oct 35.0554	Nov 35.4681	Dec 35.8995 (38)
Heat transfer coeff	79.3765	79.1397	78.9075	77.8172	77.6132	76.6636	76.6636	76.4877	77.0294	77.6132	78.0259	78.4573 (39)
Average = Sum(39)m / 12 =												77.8162 (39)
HLP	Jan 1.0190	Feb 1.0159	Mar 1.0129	Apr 0.9989	May 0.9963	Jun 0.9841	Jul 0.9841	Aug 0.9819	Sep 0.9888	Oct 0.9963	Nov 1.0016	Dec 1.0072 (40)
HLP (average)												0.9989 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	Jan 100.8897	Feb 97.2210	Mar 93.5523	Apr 89.8836	May 86.2148	Jun 82.5461	Jul 82.5461	Aug 86.2148	Sep 89.8836	Oct 93.5523	Nov 97.2210	Dec 100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)
Energy content (annual)										Total = Sum(45)m =		1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	44.7483	47.6732	44.3261	43.9341	40.7077	42.0646	43.9341	44.3261	47.6732	47.9446	50.9589 (61)
Solar input	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545 (64)
	62.4872	54.6966	56.8162	50.2246	48.5422	42.5872	40.5491	45.4467	45.9563	52.5615	56.3514	60.9175 (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	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9978	17.7619	14.4449	10.9358	8.1746	6.9013	7.4571	9.6931	13.0100	16.5192	19.2804	20.5536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	83.9882	81.3937	76.3658	69.7564	65.2449	59.1489	54.5014	61.0843	63.8283	70.6472	78.2658	81.8784	(72)
Total internal gains	381.3088	378.7093	364.7425	342.6553	320.2745	298.7057	285.1278	291.7157	303.3985	325.6953	351.1832	370.2686	(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
East					8.0000	19.6403	0.6300	0.7000			0.7700	48.0186
West					4.4600	19.6403	0.6300	0.7000			0.7700	26.7703 (76)
Solar gains	74.7889	146.3030	240.9401	351.3968	430.6500	440.8469	419.7042	360.5197	280.2234	173.6008	93.2530	61.5028 (83)
Total gains	456.0977	525.0123	605.6827	694.0521	750.9245	739.5526	704.8320	652.2354	583.6219	499.2961	444.4362	431.7713 (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	68.1527	68.3566	68.5577	69.5183	69.7010	70.5644	70.5644	70.7267	70.2294	69.7010	69.3324	68.9511	
alpha	5.5435	5.5571	5.5705	5.6346	5.6467	5.7043	5.7043	5.7151	5.6820	5.6467	5.6222	5.5967	
util living area	0.9982	0.9957	0.9862	0.9457	0.8322	0.6405	0.4748	0.5320	0.8079	0.9736	0.9961	0.9987	(86)
MIT	19.9251	20.0715	20.3238	20.6464	20.8799	20.9789	20.9967	20.9940	20.9255	20.6018	20.2047	19.9022	(87)
Th 2	20.0676	20.0701	20.0726	20.0842	20.0864	20.0966	20.0966	20.0985	20.0927	20.0864	20.0820	20.0774	(88)
util rest of house	0.9976	0.9943	0.9814	0.9272	0.7828	0.5596	0.3794	0.4316	0.7358	0.9612	0.9945	0.9983	(89)
MIT 2	18.6266	18.8420	19.2095	19.6724	19.9718	20.0829	20.0954	20.0960	20.0341	19.6207	19.0458	18.6004	(90)
Living area fraction	19.1287	19.3173	19.6404	20.0490	20.3229	20.4294	20.4439	20.4432	20.3788	20.0000	19.4939	19.1038	(91)
MIT	19.1287	19.3173	19.6404	20.0490	20.3229	20.4294	20.4439	20.4432	20.3788	20.0000	19.4939	19.1038	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1287	19.3173	19.6404	20.0490	20.3229	20.4294	20.4439	20.4432	20.3788	20.0000	19.4939	19.1038	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9968	0.9927	0.9786	0.9264	0.7966	0.5903	0.4164	0.4706	0.7604	0.9597	0.9931	0.9976	(94)
Ext temp.	454.6369	521.1948	592.6970	642.9471	598.2157	436.5519	293.4958	306.9544	443.8127	479.1645	441.3825	430.7382	(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	1177.0498	1140.9837	1036.8747	867.5839	669.2536	446.8988	294.6846	309.2553	483.6491	729.5656	967.0453	1169.3092	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating	537.4751	416.4982	330.4682	161.7385	52.8522	0.0000	0.0000	0.0000	0.0000	186.2984	378.4772	549.4968	(98)
Space heating per m2												2613.3047	(98)
												33.5469	(99)

8c. Space cooling requirement

Not applicable

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

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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													2797.9708 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	537.4751	416.4982	330.4682	161.7385	52.8522	0.0000	0.0000	0.0000	0.0000	186.2984	378.4772	549.4968	(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)	575.4552	445.9295	353.8204	173.1676	56.5870	0.0000	0.0000	0.0000	0.0000	199.4630	405.2218	588.3263	(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	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545	(64)
Efficiency of water heater (217)m	87.4121	87.1491	86.5253	85.0464	82.6262	80.3000	80.3000	80.3000	80.3000	85.2834	86.8606	87.5078	(217)
Fuel for water heating, kWh/month	229.4596	201.4982	211.1572	190.5427	189.8825	172.0825	164.8682	183.7894	185.8191	199.2281	208.8104	223.8137	(219)
Water heating fuel used												2360.9518	(219)
Annual totals kWh/year													
Space heating fuel - main system												2797.9708	(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)												353.1679	(232)
Total delivered energy for all uses												5587.0905	(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	2797.9708	0.2160	604.3617 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2360.9518	0.2160	509.9656 (264)
Space and water heating			1114.3273 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	353.1679	0.5190	183.2942 (268)
Total CO2, kg/m2/year			1336.5464 (272)
Emissions per m2 for space and water heating			14.3046 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3529 (272b)
Emissions per m2 for pumps and fans			0.4997 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3046 * 1.00) + 2.3529 + 0.4997, rounded to 2 d.p.			17.1600 (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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4700
Infiltration rate					0.3846 (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) =	0.3269 (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	0.4168	0.4087	0.4005	0.3596	0.3515	0.3106	0.3106	0.3024	0.3269	0.3515	0.3678	0.3842 (22b)
Effective ac	0.5869	0.5835	0.5802	0.5647	0.5618	0.5482	0.5482	0.5457	0.5534	0.5618	0.5676	0.5738 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			9.0000	350.5500 (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) = 16096.9100 (34)
206.6356 (35)
7.8202 (36)
(33) + (36) = 45.1462 (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	36.0578	35.8505	35.6473	34.6930	34.5145	33.6833	33.6833	33.5294	34.0035	34.5145	34.8757	35.2533 (38)
Heat transfer coeff	81.2040	80.9967	80.7935	79.8392	79.6607	78.8295	78.8295	78.6756	79.1496	79.6607	80.0219	80.3995 (39)
Average = Sum(39)m / 12 =												79.8383 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0424	1.0398	1.0371	1.0249	1.0226	1.0119	1.0119	1.0100	1.0160	1.0226	1.0272	1.0321 (40)
HLP (average)												1.0249 (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)
2.4218 (42)
91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (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	31.7935	27.8068	28.6941	25.0162	24.0037	20.7134	19.1940	22.0254	22.2884	25.9750	28.3537	30.7903 (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	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9978	17.7619	14.4449	10.9358	8.1746	6.9013	7.4571	9.6931	13.0100	16.5192	19.2804	20.5536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	42.7332	41.3792	38.5674	34.7448	32.2630	28.7685	25.7983	29.6040	30.9561	34.9126	39.3802	41.3848	(72)
Total internal gains	337.0538	335.6948	323.9441	304.6437	284.2926	265.3253	253.4247	257.2353	267.5264	286.9607	309.2976	326.7750	(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			
East				2.2000	19.6403	0.6200	0.7000	0.7700	12.9955 (76)			
West				4.4600	19.6403	0.6200	0.7000	0.7700	26.3454 (80)			
East				5.8000	19.6403	0.6200	0.7000	0.7700	34.2609 (76)			
Solar gains	73.6018	143.9807	237.1157	345.8191	423.8143	433.8494	413.0423	354.7972	275.7754	170.8452	91.7728	60.5265 (83)
Total gains	410.6556	479.6755	561.0598	650.4628	708.1069	699.1746	666.4670	612.0325	543.3018	457.8059	401.0703	387.3016 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.0634	55.2043	55.3431	56.0046	56.1301	56.7220	56.7220	56.8329	56.4925	56.1301	55.8768	55.6143	
alpha	4.6709	4.6803	4.6895	4.7336	4.7420	4.7815	4.7815	4.7889	4.7662	4.7420	4.7251	4.7076	
util living area	0.9974	0.9941	0.9832	0.9440	0.8440	0.6718	0.5092	0.5708	0.8287	0.9722	0.9948	0.9980	(86)
MIT	19.6468	19.8167	20.1128	20.4948	20.7944	20.9499	20.9892	20.9819	20.8621	20.4495	19.9769	19.6185	(87)
Th 2	20.0481	20.0503	20.0525	20.0626	20.0645	20.0734	20.0734	20.0750	20.0700	20.0645	20.0607	20.0567	(88)
util rest of house	0.9966	0.9925	0.9783	0.9272	0.7998	0.5921	0.4074	0.4655	0.7644	0.9609	0.9931	0.9974	(89)
MIT 2	18.8050	18.9760	19.2709	19.6492	19.9210	20.0482	20.0701	20.0689	19.9877	19.6136	19.1444	18.7835	(90)
Living area fraction	19.1305	19.3010	19.5964	19.9761	20.2587	20.3969	20.4255	20.4219	20.3258	19.9368	19.4663	19.1063	(91)
MIT	19.1305	19.3010	19.5964	19.9761	20.2587	20.3969	20.4255	20.4219	20.3258	19.9368	19.4663	19.1063	(92)
Temperature adjustment	19.1305	19.3010	19.5964	19.9761	20.2587	20.3969	20.4255	20.4219	20.3258	19.9368	19.4663	19.1063	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	408.8738	475.2342	547.2328	601.9253	573.4579	434.3088	297.7969	309.7927	425.9077	439.0234	397.7077	386.0140	(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	1204.2931	1166.4359	1058.1080	884.3094	681.7907	456.9640	301.5593	316.4278	492.7682	743.7782	989.5704	1198.4625	(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	591.7919	464.4875	380.0912	203.3165	80.5996	0.0000	0.0000	0.0000	0.0000	226.7376	426.1412	604.4617	(98)
Space heating													2977.6273 (98)
Space heating per m2													(98) / (4) = 38.2237 (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	740.9972	583.3382	597.9343	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8992	0.9454	0.9248	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	666.3226	551.4959	552.9603	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	907.7287	867.6695	805.6565	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	173.8124	235.2332	188.0060	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												597.0516 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	43.4531	58.8083	47.0015	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												149.2629 (107)
Space cooling per m2												1.9161 (108)
Energy for space heating												38.2237 (99)
Energy for space cooling												1.9161 (108)
Total												40.1398 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.1 (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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (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																3 * 10 =	30.0000 (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) =					30.0000	/ (5) =	0.1611 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4111 (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) =					0.3495 (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	0.4456	0.4368	0.4281	0.3844	0.3757	0.3320	0.3320	0.3233	0.3495	0.3757	0.3931	0.4106	(22b)				
Effective ac	0.5993	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5522	0.5611	0.5706	0.5773	0.5843	(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			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			12.4600	1.3258	16.5189		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.1800	5.5782		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			123.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	34.1841		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3737 (36)					
Total fabric heat loss						(33) + (36) =	42.5578 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.8186	Feb 36.5818	Mar 36.3497	Apr 35.2594	May 35.0554	Jun 34.1057	Jul 34.1057	Aug 33.9299	Sep 34.4715	Oct 35.0554	Nov 35.4681	Dec 35.8995 (38)
Heat transfer coeff	79.3765	79.1397	78.9075	77.8172	77.6132	76.6636	76.6636	76.4877	77.0294	77.6132	78.0259	78.4573 (39)
Average = Sum(39)m / 12 =												77.8162 (39)
HLP	Jan 1.0190	Feb 1.0159	Mar 1.0129	Apr 0.9989	May 0.9963	Jun 0.9841	Jul 0.9841	Aug 0.9819	Sep 0.9888	Oct 0.9963	Nov 1.0016	Dec 1.0072 (40)
HLP (average)												0.9989 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	Jan 100.8897	Feb 97.2210	Mar 93.5523	Apr 89.8836	May 86.2148	Jun 82.5461	Jul 82.5461	Aug 86.2148	Sep 89.8836	Oct 93.5523	Nov 97.2210	Dec 100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)
Energy content (annual)										Total = Sum(45)m =		1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.7935	27.8068	28.6941	25.0162	24.0037	20.7134	19.1940	22.0254	22.2884	25.9750	28.3537	30.7903 (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	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9978	17.7619	14.4449	10.9358	8.1746	6.9013	7.4571	9.6931	13.0100	16.5192	19.2804	20.5536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	42.7332	41.3792	38.5674	34.7448	32.2630	28.7685	25.7983	29.6040	30.9561	34.9126	39.3802	41.3848	(72)
Total internal gains	337.0538	335.6948	323.9441	304.6437	284.2926	265.3253	253.4247	257.2353	267.5264	286.9607	309.2976	326.7750	(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
East					8.0000	19.6403	0.6300	0.7000			0.7700			48.0186 (76)
West					4.4600	19.6403	0.6300	0.7000			0.7700			26.7703 (80)

Solar gains	74.7889	146.3030	240.9401	351.3968	430.6500	440.8469	419.7042	360.5197	280.2234	173.6008	93.2530	61.5028	(83)	
Total gains	411.8427	481.9978	564.8842	656.0405	714.9426	706.1722	673.1290	617.7550	547.7498	460.5615	402.5505	388.2778	(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	68.1527	68.3566	68.5577	69.5183	69.7010	70.5644	70.5644	70.7267	70.2294	69.7010	69.3324	68.9511	
alpha	5.5435	5.5571	5.5705	5.6346	5.6467	5.7043	5.7043	5.7151	5.6820	5.6467	5.6222	5.5967	
util living area	0.9989	0.9972	0.9900	0.9564	0.8536	0.6657	0.4962	0.5595	0.8372	0.9815	0.9976	0.9992	(86)
MIT	19.8709	20.0194	20.2767	20.6106	20.8616	20.9745	20.9959	20.9923	20.9095	20.5595	20.1537	19.8487	(87)
Th 2	20.0676	20.0701	20.0726	20.0842	20.0864	20.0966	20.0966	20.0985	20.0927	20.0864	20.0820	20.0774	(88)
util rest of house	0.9986	0.9962	0.9864	0.9409	0.8070	0.5837	0.3970	0.4551	0.7692	0.9723	0.9966	0.9990	(89)
MIT 2	19.0297	19.1799	19.4373	19.7705	19.9947	20.0851	20.0955	20.0963	20.0426	19.7286	19.3240	19.0156	(90)
Living area fraction	19.3550	19.5045	19.7619	20.0953	20.3299	20.4290	20.4437	20.4427	fLA = Living area / (4) =	20.3778	20.0499	19.6448	0.3866 (91)
MIT	19.3550	19.5045	19.7619	20.0953	20.3299	20.4290	20.4437	20.4427	20.3778	20.0499	19.6448	19.3377	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3550	19.5045	19.7619	20.0953	20.3299	20.4290	20.4437	20.4427	20.3778	20.0499	19.6448	19.3377	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	411.1065	479.8135	556.3543	617.3814	586.6121	434.2181	293.1740	306.2301	434.1858	447.5898	400.9419	387.7766	(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	1195.0103	1155.7935	1046.4618	871.1867	669.7935	446.8700	294.6684	309.2172	483.5721	733.4354	978.8202	1187.6644	(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	583.2244	454.2586	364.6400	182.7398	61.8870	0.0000	0.0000	0.0000	0.0000	212.6692	416.0724	595.1165	(98)
Space heating												2870.6078	(98)
Space heating per m2												36.8499	(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	720.6376	567.3104	581.3066	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9321	0.9687	0.9530	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	671.7047	549.5302	554.0008	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	915.9077	875.4563	812.3452	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	175.8261	242.4890	192.2083	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												610.5234	(104)
Cooled fraction												1.0000	(105)

$$fC = \text{cooled area} / (4) =$$

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	43.9565	60.6223	48.0521	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											152.6308 (107)
Space cooling per m2											1.9593 (108)
Energy for space heating											36.8499 (99)
Energy for space cooling											1.9593 (108)
Total											38.8092 (109)
Target Fabric Energy Efficiency (TFEE)											44.6 (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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4700
Infiltration rate					0.3846 (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) =	0.3269 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3433	0.3188	0.3269	0.3106	0.3106	0.3024	0.2942	0.2861	0.2779	0.3024	0.2861	0.3024 (22b)
	0.5589	0.5508	0.5534	0.5482	0.5482	0.5457	0.5433	0.5409	0.5386	0.5457	0.5409	0.5457 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16447.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							211.1356 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8202 (36)
Total fabric heat loss							(33) + (36) = 45.1462 (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	34.3400	33.8413	34.0035	33.6833	33.6833	33.5294	33.3796	33.2339	33.0923	33.5294	33.2339	33.5294 (38)
Heat transfer coeff	79.4862	78.9875	79.1496	78.8295	78.8295	78.6756	78.5258	78.3800	78.2384	78.6756	78.3800	78.6756 (39)
Average = Sum(39)m / 12 =												78.7361 (39)
HLP	1.0204	1.0140	1.0160	1.0119	1.0119	1.0100	1.0080	1.0062	1.0043	1.0100	1.0062	1.0100 (40)
HLP (average)												1.0107 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(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			
East				2.2000	25.1925	0.6200	0.7000	0.7700	16.6693 (76)			
West				4.4600	25.1925	0.6200	0.7000	0.7700	33.7932 (80)			
East				5.8000	25.1925	0.6200	0.7000	0.7700	43.9464 (76)			
Solar gains	94.4089	157.0960	260.0966	380.0377	441.2754	490.1088	463.1740	408.6618	318.9681	200.9605	117.3300	76.3139 (83)
Total gains	642.6050	700.9007	782.7973	870.0960	897.9808	916.9494	872.5857	826.3095	755.4267	670.2708	623.1116	609.6244 (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	57.4784	57.8413	57.7228	57.9572	57.9572	58.0706	58.1814	58.2896	58.3951	58.0706	58.2896	58.0706
alpha	4.8319	4.8561	4.8482	4.8638	4.8638	4.8714	4.8788	4.8860	4.8930	4.8714	4.8860	4.8714
util living area	0.9818	0.9718	0.9373	0.8460	0.6906	0.4813	0.3496	0.3681	0.6219	0.8752	0.9638	0.9847 (86)
MIT	20.0835	20.2093	20.4707	20.7588	20.9294	20.9899	20.9983	20.9979	20.9673	20.7612	20.3961	20.0678 (87)
Th 2	20.0664	20.0717	20.0700	20.0734	20.0734	20.0750	20.0766	20.0782	20.0797	20.0750	20.0782	20.0750 (88)
util rest of house	0.9771	0.9646	0.9217	0.8112	0.6312	0.4066	0.2676	0.2821	0.5426	0.8371	0.9530	0.9806 (89)
MIT 2	18.8713	19.0551	19.4219	19.8087	20.0107	20.0691	20.0761	20.0775	20.0569	19.8233	19.3296	18.8554 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	19.3400	19.5014	19.8274	20.1761	20.3659	20.4251	20.4326	20.4333	20.4089	20.1859	19.7420	19.3241 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1900	19.3514	19.6774	20.0261	20.2159	20.2751	20.2826	20.2833	20.2589	20.0359	19.5920	19.1741 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9713	0.9576	0.9139	0.8092	0.6408	0.4230	0.2860	0.3014	0.5587	0.8353	0.9458	0.9754 (94)
Useful gains	624.1406	671.1718	715.3679	704.0788	575.3916	387.8473	249.5196	249.0095	422.0392	559.8544	589.3371	594.6084 (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	1135.8599	1109.8858	1003.4120	829.7654	608.2427	391.4189	249.9198	249.5111	434.9187	679.4354	916.4197	1115.1578 (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	380.7192	294.8158	214.3048	90.4943	24.4412	0.0000	0.0000	0.0000	0.0000	88.9682	235.4994	387.2887 (98)
Space heating												1716.5317 (98)
RHI space heating demand												1717 (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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4700
Infiltration rate					0.3846 (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) =	0.3269 (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	0.4168	0.4087	0.4005	0.3596	0.3515	0.3106	0.3106	0.3024	0.3269	0.3515	0.3678	0.3842 (22b)
Effective ac	0.5869	0.5835	0.5802	0.5647	0.5618	0.5482	0.5482	0.5457	0.5534	0.5618	0.5676	0.5738 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16447.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							211.1356 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8202 (36)
Total fabric heat loss							(33) + (36) = 45.1462 (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	36.0578	35.8505	35.6473	34.6930	34.5145	33.6833	33.6833	33.5294	34.0035	34.5145	34.8757	35.2533 (38)
Heat transfer coeff	81.2040	80.9967	80.7935	79.8392	79.6607	78.8295	78.8295	78.6756	79.1496	79.6607	80.0219	80.3995 (39)
Average = Sum(39)m / 12 =												79.8383 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0424	1.0398	1.0371	1.0249	1.0226	1.0119	1.0119	1.0100	1.0160	1.0226	1.0272	1.0321 (40)
HLP (average)												1.0249 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (64)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(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	
East	2.2000				19.6403		0.6200		0.7000		0.7700		12.9955 (76)	
West	4.4600				19.6403		0.6200		0.7000		0.7700		26.3454 (80)	
East	5.8000				19.6403		0.6200		0.7000		0.7700		34.2609 (76)	
Solar gains	73.6018	143.9807	237.1157	345.8191	423.8143	433.8494	413.0423	354.7972	275.7754	170.8452	91.7728	60.5265 (83)		
Total gains	621.7979	687.7854	759.8164	835.8775	880.5198	860.6899	822.4539	772.4450	712.2339	640.1555	597.5544	593.8370 (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	56.2625	56.4065	56.5483	57.2243	57.3525	57.9572	57.9572	58.0706	57.7228	57.3525	57.0936	56.8255
alpha	4.7508	4.7604	4.7699	4.8150	4.8235	4.8638	4.8638	4.8714	4.8482	4.8235	4.8062	4.7884
util living area	0.9865	0.9769	0.9515	0.8820	0.7499	0.5673	0.4180	0.4623	0.7042	0.9157	0.9760	0.9890 (86)
MIT	19.9558	20.1108	20.3686	20.6771	20.8863	20.9770	20.9957	20.9931	20.9370	20.6579	20.2537	19.9243 (87)
Th 2	20.0481	20.0503	20.0525	20.0626	20.0645	20.0734	20.0734	20.0750	20.0700	20.0645	20.0607	20.0567 (88)
util rest of house	0.9830	0.9710	0.9390	0.8534	0.6970	0.4925	0.3319	0.3724	0.6298	0.8884	0.9688	0.9861 (89)
MIT 2	18.6735	18.8981	19.2661	19.6951	19.9557	20.0576	20.0716	20.0719	20.0204	19.6815	19.1140	18.6341 (90)
Living area fraction	19.1693	19.3670	19.6924	20.0748	20.3155	20.4131	20.4289	20.4281	20.3748	20.0590	19.5547	19.1330 (92)
MIT	19.1693	19.3670	19.6924	20.0748	20.3155	20.4131	20.4289	20.4281	20.3748	20.0590	19.5547	19.1330 (92)
Temperature adjustment	19.0193	19.2170	19.5424	19.9248	20.1655	20.2631	20.2789	20.2781	20.2248	19.9090	19.4047	-0.1500
adjusted MIT	19.0193	19.2170	19.5424	19.9248	20.1655	20.2631	20.2789	20.2781	20.2248	19.9090	19.4047	18.9830 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9780	0.9644	0.9309	0.8487	0.7031	0.5082	0.3512	0.3924	0.6430	0.8831	0.9623	0.9816 (94)
Useful gains	608.1021	663.2989	707.3192	709.4100	619.0583	437.4069	288.8244	303.1032	457.9756	565.2902	575.0115	582.9254 (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	1195.2655	1159.6262	1053.7406	880.2104	674.3679	446.4192	290.0065	305.1119	484.7769	741.5641	984.6451	1188.5440 (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	436.8495	333.5320	257.7375	122.9763	41.1503	0.0000	0.0000	0.0000	0.0000	131.1477	294.9362	450.5802 (98)
Space heating												2068.9098 (98)
Space heating per m2												(98) / (4) = 26.5585 (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													2298.7887	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	436.8495	333.5320	257.7375	122.9763	41.1503	0.0000	0.0000	0.0000	0.0000	131.1477	294.9362	450.5802	(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)	485.3884	370.5911	286.3750	136.6403	45.7226	0.0000	0.0000	0.0000	0.0000	145.7197	327.7069	500.6447	(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	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)	
Efficiency of water heater (217)m	89.0480	88.9507	88.7270	88.2250	87.4545	86.7000	86.7000	86.7000	86.7000	88.2474	88.8415	89.0876	(217)	
Fuel for water heating, kWh/month	191.6084	168.4029	175.7504	156.2881	152.9262	135.5563	128.0378	143.4793	144.1738	162.1470	172.9977	186.2014	(219)	
Water heating fuel used												1917.5694	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2298.7887	(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)													353.1679	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930			-392.1930	(233)
Total delivered energy for all uses													4252.3330	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2298.7887	3.4800	79.9978	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1917.5694	3.4800	66.7314	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	353.1679	13.1900	46.5828	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-392.1930	13.1900	-51.7303	(252)
Total energy cost			271.4743	(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] =	0.9277	(257)
SAP value		87.0580	
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	2298.7887	0.2160	496.5384	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1917.5694	0.2160	414.1950	(264)
Space and water heating			910.7333	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	353.1679	0.5190	183.2942	(268)
Energy saving/generation technologies				
PV Unit	-392.1930	0.5190	-203.5482	(269)
Total kg/year			929.4043	(272)
CO2 emissions per m2			11.9300	(273)
EI value			89.8665	
EI rating			90	(274)
EI band			B	

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency
Main heating environmental impact
Water heating energy efficiency
Water heating environmental impact

$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
 $0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
 $3.48 / 0.8795 = 3.957$, stars = 4
 $0.216 / 0.8795 = 0.2456$, 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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4700
Infiltration rate					0.3846 (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)	=	0.3269 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3433	0.3188	0.3269	0.3106	0.3106	0.3024	0.2942	0.2861	0.2779	0.3024	0.2861	0.3024 (22b)
	0.5589	0.5508	0.5534	0.5482	0.5482	0.5457	0.5433	0.5409	0.5386	0.5457	0.5409	0.5457 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (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) = 16447.4600 (34)
211.1356 (35)
7.8202 (36)
(33) + (36) = 45.1462 (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	34.3400	33.8413	34.0035	33.6833	33.6833	33.5294	33.3796	33.2339	33.0923	33.5294	33.2339	33.5294 (38)
Heat transfer coeff	79.4862	78.9875	79.1496	78.8295	78.8295	78.6756	78.5258	78.3800	78.2384	78.6756	78.3800	78.6756 (39)
Average = Sum(39)m / 12 =												78.7361 (39)
HLP	1.0204	1.0140	1.0160	1.0119	1.0119	1.0100	1.0080	1.0062	1.0043	1.0100	1.0062	1.0100 (40)
HLP (average)												1.0107 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (64)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(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	
East												2.2000		25.1925		0.6200		0.7000		0.7700		16.6693	(76)
West												4.4600		25.1925		0.6200		0.7000		0.7700		33.7932	(80)
East												5.8000		25.1925		0.6200		0.7000		0.7700		43.9464	(76)
Solar gains	94.4089	157.0960	260.0966	380.0377	441.2754	490.1088	463.1740	408.6618	318.9681	200.9605	117.3300	76.3139	(83)										
Total gains	642.6050	700.9007	782.7973	870.0960	897.9808	916.9494	872.5857	826.3095	755.4267	670.2708	623.1116	609.6244	(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	57.4784	57.8413	57.7228	57.9572	57.9572	58.0706	58.1814	58.2896	58.3951	58.0706	58.2896	58.0706
alpha	4.8319	4.8561	4.8482	4.8638	4.8638	4.8714	4.8788	4.8860	4.8930	4.8714	4.8860	4.8714
util living area	0.9818	0.9718	0.9373	0.8460	0.6906	0.4813	0.3496	0.3681	0.6219	0.8752	0.9638	0.9847 (86)
MIT	20.0835	20.2093	20.4707	20.7588	20.9294	20.9899	20.9983	20.9979	20.9673	20.7612	20.3961	20.0678 (87)
Th 2	20.0664	20.0717	20.0700	20.0734	20.0734	20.0750	20.0766	20.0782	20.0797	20.0750	20.0782	20.0750 (88)
util rest of house	0.9771	0.9646	0.9217	0.8112	0.6312	0.4066	0.2676	0.2821	0.5426	0.8371	0.9530	0.9806 (89)
MIT 2	18.8713	19.0551	19.4219	19.8087	20.0107	20.0691	20.0761	20.0775	20.0569	19.8233	19.3296	18.8554 (90)
Living area fraction	19.3400	19.5014	19.8274	20.1761	20.3659	20.4251	20.4326	20.4333	20.4089	20.1859	19.7420	19.3241 (91)
MIT	19.3400	19.5014	19.8274	20.1761	20.3659	20.4251	20.4326	20.4333	20.4089	20.1859	19.7420	19.3241 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1900	19.3514	19.6774	20.0261	20.2159	20.2751	20.2826	20.2833	20.2589	20.0359	19.5920	19.1741 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9713	0.9576	0.9139	0.8092	0.6408	0.4230	0.2860	0.3014	0.5587	0.8353	0.9458	0.9754	0.9754	(94)
Useful gains	624.1406	671.1718	715.3679	704.0788	575.3916	387.8473	249.5196	249.0095	422.0392	559.8544	589.3371	594.6084	(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	1135.8599	1109.8858	1003.4120	829.7654	608.2427	391.4189	249.9198	249.5111	434.9187	679.4354	916.4197	1115.1578	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	380.7192	294.8158	214.3048	90.4943	24.4412	0.0000	0.0000	0.0000	0.0000	88.9682	235.4994	387.2887	(98)
Space heating												1716.5317	(98)
Space heating per m2												22.0351	(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													1907.2575	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	380.7192	294.8158	214.3048	90.4943	24.4412	0.0000	0.0000	0.0000	0.0000	88.9682	235.4994	387.2887	(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)	423.0213	327.5731	238.1164	100.5493	27.1569	0.0000	0.0000	0.0000	0.0000	98.8536	261.6660	430.3208	(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	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)	
Efficiency of water heater (217)m	88.9522	88.8605	88.5800	87.9782	87.1940	86.7000	86.7000	86.7000	86.7000	87.9362	88.6672	88.9843	(216)	
Fuel for water heating, kWh/month	191.8147	168.5739	176.0421	156.7265	153.3831	135.5563	128.0378	143.4793	144.1738	162.7210	173.3378	186.4174	(219)	
Water heating fuel used												1920.2636	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1907.2575	(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)													353.1679	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 1031 * 1.00) =										-445.3995			-445.3995	(233)
Total delivered energy for all uses													3810.2895	(238)

10a. Fuel costs - using BEDF prices (441)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1907.2575	3.9200	74.7645 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1920.2636	3.9200	75.2743 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	353.1679	16.9600	59.8973 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-445.3995	16.9600	-75.5398 (252)
Total energy cost			235.1163 (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	1907.2575	0.2160	411.9676 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1920.2636	0.2160	414.7769 (264)
Space and water heating			826.7446 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	353.1679	0.5190	183.2942 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	0.5190	-231.1624 (269)
Total kg/year			817.8013 (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	1907.2575	1.2200	2326.8541 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1920.2636	1.2200	2342.7216 (264)
Space and water heating			4669.5757 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	353.1679	3.0700	1084.2255 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			4616.6747 (272)
Primary energy kWh/m2/year			59.2641 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 90

(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	+ 1.3	-£ 31	-189 kg (23.1%)

		Typical annual savings	Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£31	2.43 kg/m²	B 88	A 92
Total Savings	£31	2.43 kg/m²		
Potential energy efficiency rating:			B 88	
Potential environmental impact rating:				A 92

Fuel prices for cost data on this page from database revision number 441 TEST (27 Mar 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	£73	£81	-£8
Mains gas	£238	£199	£39
Space heating	£175	£175	£0
Water heating	£75	£45	£31
Lighting	£60	£60	£0
Generated (PV)	-£76	-£76	£0
Total cost of fuels	£235	£204	£31
Total cost of uses	£234	£204	£31
Delivered energy	49 kWh/m²	37 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	46 kWh/m²	14 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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) =					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4700
Infiltration rate					0.3846 (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) = 0.3269 (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	0.4168	0.4087	0.4005	0.3596	0.3515	0.3106	0.3106	0.3024	0.3269	0.3515	0.3678	0.3842 (22b)
Effective ac	0.5869	0.5835	0.5802	0.5647	0.5618	0.5482	0.5482	0.5457	0.5534	0.5618	0.5676	0.5738 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (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) = 16447.4600 (34)
211.1356 (35)
7.8202 (36)
(33) + (36) = 45.1462 (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	36.0578	35.8505	35.6473	34.6930	34.5145	33.6833	33.6833	33.5294	34.0035	34.5145	34.8757	35.2533 (38)
Heat transfer coeff	81.2040	80.9967	80.7935	79.8392	79.6607	78.8295	78.8295	78.6756	79.1496	79.6607	80.0219	80.3995 (39)
Average = Sum(39)m / 12 =												79.8383 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0424	1.0398	1.0371	1.0249	1.0226	1.0119	1.0119	1.0100	1.0160	1.0226	1.0272	1.0321 (40)
HLP (average)												1.0249 (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)
2.4218 (42)
91.7179 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 =	1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m													
	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645	20.9866 (61)	
Total heat required for water heating calculated for each month	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (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												1.2568 (H8)	
Utilisation factor												0.5487 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												91.7179 (H14)	
Volume ratio Veff/V												0.8177 (H15)	
Solar storage volume factor												0.9598 (H16)	
Solar input												-839.8420 (H17)	
Solar input	-24.3537	-40.6394	-69.2135	-92.7598	-114.5969	-112.6670	-111.1781	-97.1368	-76.0776	-51.9521	-28.8870	-20.3799 (63)	
	Solar input (sum of months) = Sum(63)m =											-839.8420 (63)	
Output from w/h	146.2697	109.1561	86.7245	45.1254	19.1439	4.8603	0.0000	27.2597	48.9211	91.1385	124.8068	145.5023 (64)	
	Total per year (kWh/year) = Sum(64)m =											848.9084 (64)	
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(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

East	2.2000	19.6403	0.6200	0.7000	0.7700	12.9955 (76)
West	4.4600	19.6403	0.6200	0.7000	0.7700	26.3454 (80)
East	5.8000	19.6403	0.6200	0.7000	0.7700	34.2609 (76)

Solar gains	73.6018	143.9807	237.1157	345.8191	423.8143	433.8494	413.0423	354.7972	275.7754	170.8452	91.7728	60.5265 (83)
Total gains	621.7979	687.7854	759.8164	835.8775	880.5198	860.6899	822.4539	772.4450	712.2339	640.1555	597.5544	593.8370 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	56.2625	56.4065	56.5483	57.2243	57.3525	57.9572	57.9572	58.0706	57.7228	57.3525	57.0936	56.8255
util living area	4.7508	4.7604	4.7699	4.8150	4.8235	4.8638	4.8638	4.8714	4.8482	4.8235	4.8062	4.7884
	0.9865	0.9769	0.9515	0.8820	0.7499	0.5673	0.4180	0.4623	0.7042	0.9157	0.9760	0.9890 (86)
MIT	19.9558	20.1108	20.3686	20.6771	20.8863	20.9770	20.9957	20.9931	20.9370	20.6579	20.2537	19.9243 (87)
Th 2	20.0481	20.0503	20.0525	20.0626	20.0645	20.0734	20.0734	20.0750	20.0700	20.0645	20.0607	20.0567 (88)
util rest of house	0.9830	0.9710	0.9390	0.8534	0.6970	0.4925	0.3319	0.3724	0.6298	0.8884	0.9688	0.9861 (89)
MIT 2	18.6735	18.8981	19.2661	19.6951	19.9557	20.0576	20.0716	20.0719	20.0204	19.6815	19.1140	18.6341 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	19.1693	19.3670	19.6924	20.0748	20.3155	20.4131	20.4289	20.4281	20.3748	20.0590	19.5547	19.1330 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0193	19.2170	19.5424	19.9248	20.1655	20.2631	20.2789	20.2781	20.2248	19.9090	19.4047	18.9830 (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	0.9780	0.9644	0.9309	0.8487	0.7031	0.5082	0.3512	0.3924	0.6430	0.8831	0.9623	0.9816	(94)
Useful gains	608.1021	663.2989	707.3192	709.4100	619.0583	437.4069	288.8244	303.1032	457.9756	565.2902	575.0115	582.9254	(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	1195.2655	1159.6262	1053.7406	880.2104	674.3679	446.4192	290.0065	305.1119	484.7769	741.5641	984.6451	1188.5440	(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	436.8495	333.5320	257.7375	122.9763	41.1503	0.0000	0.0000	0.0000	0.0000	131.1477	294.9362	450.5802	(98)
Space heating												2068.9098	(98)
Space heating per m2											(98) / (4) =	26.5585	(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													2298.7887	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	436.8495	333.5320	257.7375	122.9763	41.1503	0.0000	0.0000	0.0000	0.0000	131.1477	294.9362	450.5802	(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)	485.3884	370.5911	286.3750	136.6403	45.7226	0.0000	0.0000	0.0000	0.0000	145.7197	327.7069	500.6447	(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	146.2697	109.1561	86.7245	45.1254	19.1439	4.8603	0.0000	27.2597	48.9211	91.1385	124.8068	145.5023	(64)	
Efficiency of water heater	89.1488	89.1632	89.1457	89.0897	88.9253	86.7000	86.7000	86.7000	86.7000	88.6171	88.9928	89.1715	(217)	
Fuel for water heating, kWh/month	164.0736	122.4229	97.2839	50.6516	21.5281	5.6058	0.0000	31.4414	56.4257	102.8453	140.2437	163.1713	(219)	
Water heating fuel used												955.6935	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2298.7887	(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)													353.1679	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930			-392.1930	(233)
Total delivered energy for all uses													3340.4570	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2298.7887	3.4800	79.9978 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	955.6935	3.4800	33.2581 (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	353.1679	13.1900	46.5828 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-392.1930	13.1900	-51.7303 (252)
Total energy cost			244.5961 (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] =	0.8359 (257)
SAP value		88.3394
SAP rating (Section 12)		88 (258)
SAP band		B

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2298.7887	0.2160	496.5384 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	955.6935	0.2160	206.4298 (264)
Space and water heating			702.9681 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	353.1679	0.5190	183.2942 (268)
Energy saving/generation technologies			
PV Unit	-392.1930	0.5190	-203.5482 (269)
Total kg/year			747.5891 (272)
CO2 emissions per m2			9.6000 (273)
EI value			91.8489
EI rating			92 (274)
EI band			A

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	38.9500 (1b)	x 2.3100 (2b)	= 89.9745 (1b) - (3b)
First floor	38.9500 (1c)	x 2.4700 (2c)	= 96.2065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	77.9000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 186.1810 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					4.4700
Infiltration rate					0.3846 (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)	=	0.3269 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3433	0.3188	0.3269	0.3106	0.3106	0.3024	0.2942	0.2861	0.2779	0.3024	0.2861	0.3024 (22b)
	0.5589	0.5508	0.5534	0.5482	0.5482	0.5457	0.5433	0.5409	0.5386	0.5457	0.5409	0.5457 (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 FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 16447.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							211.1356 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8202 (36)
Total fabric heat loss							(33) + (36) = 45.1462 (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	34.3400	33.8413	34.0035	33.6833	33.6833	33.5294	33.3796	33.2339	33.0923	33.5294	33.2339	33.5294 (38)
Heat transfer coeff	79.4862	78.9875	79.1496	78.8295	78.8295	78.6756	78.5258	78.3800	78.2384	78.6756	78.3800	78.6756 (39)
Average = Sum(39)m / 12 =												78.7361 (39)
HLP	1.0204	1.0140	1.0160	1.0119	1.0119	1.0100	1.0080	1.0062	1.0043	1.0100	1.0062	1.0100 (40)
HLP (average)												1.0107 (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												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	100.8897	97.2210	93.5523	89.8836	86.2148	82.5461	82.5461	86.2148	89.8836	93.5523	97.2210	100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (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 = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (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	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1208.1510 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											2029.6937 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.4065 (H8)
Collector performance factor											0.5088 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											91.7179 (H14)
Solar storage volume factor											0.8177 (H15)
Solar input											0.9598 (H16)
Solar input	-28.4329	-40.4298	-69.4891	-93.7569	-110.1231	-117.6288	-115.1551	-103.0673	-80.6946	-55.7895	-33.6286 (H17)
Output from w/h											
142.1906	109.3658	86.4489	44.1284	23.6178	0.0000	0.0000	21.3293	44.3042	87.3011	120.0652	142.5021 (64)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (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	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(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)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(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

East	2.2000	25.1925	0.6200	0.7000	0.7700	16.6693 (76)
West	4.4600	25.1925	0.6200	0.7000	0.7700	33.7932 (80)
East	5.8000	25.1925	0.6200	0.7000	0.7700	43.9464 (76)

Solar gains	94.4089	157.0960	260.0966	380.0377	441.2754	490.1088	463.1740	408.6618	318.9681	200.9605	117.3300	76.3139 (83)
Total gains	642.6050	700.9007	782.7973	870.0960	897.9808	916.9494	872.5857	826.3095	755.4267	670.2708	623.1116	609.6244 (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	57.4784	57.8413	57.7228	57.9572	57.9572	58.0706	58.1814	58.2896	58.3951	58.0706	58.2896	58.0706
alpha	4.8319	4.8561	4.8482	4.8638	4.8638	4.8714	4.8788	4.8860	4.8930	4.8714	4.8860	4.8714
util living area												
	0.9818	0.9718	0.9373	0.8460	0.6906	0.4813	0.3496	0.3681	0.6219	0.8752	0.9638	0.9847 (86)
MIT	20.0835	20.2093	20.4707	20.7588	20.9294	20.9899	20.9983	20.9979	20.9673	20.7612	20.3961	20.0678 (87)
Th 2	20.0664	20.0717	20.0700	20.0734	20.0734	20.0750	20.0766	20.0782	20.0797	20.0750	20.0782	20.0750 (88)
util rest of house												
	0.9771	0.9646	0.9217	0.8112	0.6312	0.4066	0.2676	0.2821	0.5426	0.8371	0.9530	0.9806 (89)
MIT 2	18.8713	19.0551	19.4219	19.8087	20.0107	20.0691	20.0761	20.0775	20.0569	19.8233	19.3296	18.8554 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	19.3400	19.5014	19.8274	20.1761	20.3659	20.4251	20.4326	20.4333	20.4089	20.1859	19.7420	19.3241 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1900	19.3514	19.6774	20.0261	20.2159	20.2751	20.2826	20.2833	20.2589	20.0359	19.5920	19.1741 (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	0.9713	0.9576	0.9139	0.8092	0.6408	0.4230	0.2860	0.3014	0.5587	0.8353	0.9458	0.9754	(94)
Useful gains	624.1406	671.1718	715.3679	704.0788	575.3916	387.8473	249.5196	249.0095	422.0392	559.8544	589.3371	594.6084	(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	1135.8599	1109.8858	1003.4120	829.7654	608.2427	391.4189	249.9198	249.5111	434.9187	679.4354	916.4197	1115.1578	(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	380.7192	294.8158	214.3048	90.4943	24.4412	0.0000	0.0000	0.0000	0.0000	88.9682	235.4994	387.2887	(98)
Space heating												1716.5317	(98)
Space heating per m2												(98) / (4) =	22.0351 (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													1907.2575 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	380.7192	294.8158	214.3048	90.4943	24.4412	0.0000	0.0000	0.0000	0.0000	88.9682	235.4994	387.2887	(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)	423.0213	327.5731	238.1164	100.5493	27.1569	0.0000	0.0000	0.0000	0.0000	98.8536	261.6660	430.3208	(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	142.1906	109.3658	86.4489	44.1284	23.6178	0.0000	0.0000	21.3293	44.3042	87.3011	120.0652	142.5021	(64)
Efficiency of water heater	89.0780	89.0825	89.0260	88.8909	88.3475	86.7000	86.7000	86.7000	86.7000	88.3348	88.8579	89.0879	(217)
Fuel for water heating, kWh/month	159.6247	122.7690	97.1053	49.6432	26.7329	0.0000	0.0000	24.6013	51.1005	98.8298	135.1204	159.9567	(219)
Water heating fuel used												925.4839	(219)
Annual totals kWh/year													
Space heating fuel - main system												1907.2575	(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)													353.1679 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1031 * 1.00) =									-445.3995			-445.3995	(233)
Total delivered energy for all uses												2865.5098	(238)

10a. Fuel costs - using BEDF prices (441)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1907.2575	3.9200	74.7645	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	925.4839	3.9200	36.2790	(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	353.1679	16.9600	59.8973	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-445.3995	16.9600	-75.5398	(252)
Total energy cost			204.6010	(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	1907.2575	0.2160	411.9676	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	925.4839	0.2160	199.9045	(264)
Space and water heating			611.8721	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	353.1679	0.5190	183.2942	(268)
Energy saving/generation technologies				
PV Unit	-445.3995	0.5190	-231.1624	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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

Total kg/year 628.8789 (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	1907.2575	1.2200	2326.8541 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	925.4839	1.2200	1129.0904 (264)
Space and water heating			3455.9445 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	353.1679	3.0700	1084.2255 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			3556.5435 (272)
Primary energy kWh/m2/year			45.6552 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	211.1 (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	245.76 (P1)
Transmission heat loss coefficient	45.15 (37)
Summer heat loss coefficient	290.91 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	2.2000	125.2818	0.6200	0.7000	0.9000	96.8914
West	4.4600	125.2818	0.6200	0.7000	0.9000	196.4254
East	5.8000	125.2818	0.6200	0.7000	0.9000	255.4410
total:						548.7578

	Jun	Jul	Aug	
Solar gains	590	549	483	(P3)
Internal gains	424	406	415	
Total summer gains	1014	955	897	(P5)
Summer gain/loss ratio	3.49	3.28	3.08	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 211.1)	0.52	0.52	0.52	
Threshold temperature	19.41	21.11	20.91	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			