

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-170			Issued on Date	26/04/2019
Assessment Reference	As Built	Prop Type Ref	2302 - End (As)		
Property	56, St Andrews Road, Botley, SOUTHAMPTON, SO32 2ST				
SAP Rating	87 B	DER	14.29	TER	18.63
Environmental	89 B	% DER<TER	23.30		
CO ₂ Emissions (t/year)	0.83	DFEE	48.16	TFEE	52.32
General Requirements Compliance	Pass	% DFEE<TFEE	7.95		
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

End-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) 18.63 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.29 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 48.2 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	0.18 (max. 0.25)	0.18 (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: 4.57 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Potterton Promax Ultra Combi 40 ErP
Combi boiler
Efficiency: 89.1% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading: Average
Windows facing North: 0.57 m², No overhang
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 0.81 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					4.5700
Infiltration rate					0.3896 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3604 (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	0.4595	0.4505	0.4415	0.3965	0.3874	0.3424	0.3424	0.3334	0.3604	0.3874	0.4055	0.4235 (22b)
Effective ac	0.6056	0.6015	0.5975	0.5786	0.5751	0.5586	0.5586	0.5556	0.5649	0.5751	0.5822	0.5897 (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)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (28a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum, (m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (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) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (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	37.2067	36.9549	36.7079	35.5482	35.3313	34.3212	34.3212	34.1341	34.7103	35.3313	35.7702	36.2291 (38)
Heat transfer coeff	93.1004	92.8485	92.6016	91.4418	91.2249	90.2148	90.2148	90.0278	90.6039	91.2249	91.6638	92.1227 (39)
Average = Sum(39)m / 12 =												91.4408 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1951	1.1919	1.1887	1.1738	1.1711	1.1581	1.1581	1.1557	1.1631	1.1711	1.1767	1.1826 (40)
HLP (average)												1.1738 (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)

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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	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)
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												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
121.0904	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												
19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(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	(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												
371.0735	368.9563	355.6250	334.1715	312.4252	291.4749	277.8798	283.8418	294.8798	316.5428	341.4074	360.0217	(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
North					0.5700	10.6334	0.6200	0.7000	0.7700				1.8229 (74)
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	75.4247	147.4644	243.0354	355.3276	436.6231	447.5616	425.8444	364.9541	282.8927	174.9921	94.0216	62.0462 (83)	
Total gains	446.4982	516.4207	598.6604	689.4991	749.0483	739.0365	703.7242	648.7958	577.7725	491.5349	435.4290	422.0679 (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	43.1233	43.2403	43.3556	43.9054	44.0099	44.5026	44.5026	44.5951	44.3115	44.0099	43.7991	43.5809
alpha	3.8749	3.8827	3.8904	3.9270	3.9340	3.9668	3.9668	3.9730	3.9541	3.9340	3.9199	3.9054
util living area	0.9943	0.9894	0.9756	0.9348	0.8437	0.6904	0.5371	0.5948	0.8283	0.9623	0.9902	0.9954 (86)
MIT	19.3351	19.5242	19.8613	20.3044	20.6739	20.8985	20.9713	20.9574	20.7787	20.2830	19.7312	19.3053 (87)
Th 2	19.9239	19.9265	19.9290	19.9410	19.9432	19.9537	19.9537	19.9556	19.9497	19.9432	19.9387	19.9340 (88)
util rest of house	0.9928	0.9866	0.9690	0.9163	0.7989	0.6059	0.4212	0.4778	0.7623	0.9480	0.9871	0.9943 (89)
MIT 2	17.7039	17.9808	18.4704	19.1076	19.6042	19.8757	19.9401	19.9333	19.7516	19.0904	18.2919	17.6669 (90)
Living area fraction												
MIT	18.3346	18.5776	19.0082	19.5703	20.0178	20.2712	20.3388	20.3292	20.1488	19.5516	18.8484	18.3004 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1846	18.4276	18.8582	19.4203	19.8678	20.1212	20.1888	20.1792	19.9988	19.4016	18.6984	18.1504 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9893	0.9811	0.9600	0.9050	0.7952	0.6205	0.4484	0.5044	0.7659	0.9383	0.9819	0.9913	(94)
Useful gains	441.7192	506.6478	574.6985	623.9941	595.6551	458.5765	315.5536	327.2589	442.5247	461.1844	427.5619	418.3884	(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													
	1292.6624	1256.0136	1144.3888	961.9973	745.1073	498.0925	323.7634	340.2353	534.4498	802.9213	1063.1579	1285.1442	(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													
	633.1017	503.5738	423.8496	243.3623	111.1924	0.0000	0.0000	0.0000	0.0000	254.2523	457.6292	644.8663	(98)
Space heating													
Space heating per m2													
												(98) / (4) =	42.0004 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	90.0000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	3635.3641 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	633.1017	503.5738	423.8496	243.3623	111.1924	0.0000	0.0000	0.0000	0.0000	254.2523	457.6292	644.8663 (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)	703.4463	559.5265	470.9440	270.4026	123.5472	0.0000	0.0000	0.0000	0.0000	282.5025	508.4769	716.5182 (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	89.2786	89.2214	89.0880	88.7779	88.1676	86.7000	86.7000	86.7000	86.7000	88.7831	89.1469	86.7000 (216)
Fuel for water heating, kWh/month	191.1135	167.8919	175.0382	155.3148	151.6893	135.5563	128.0378	143.4793	144.1738	161.1688	172.4051	185.7490 (219)
Water heating fuel used	1911.6178 (219)											
Annual totals kWh/year												
Space heating fuel - main system	3635.3641 (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)	350.1515 (232)											
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =	-588.2895											
Total delivered energy for all uses	5383.8439 (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	3635.3641	0.2160	785.2386 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1911.6178	0.2160	412.9095 (264)
Space and water heating			1198.1481 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total CO2, kg/year			1113.4795 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2900 (273)

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

DER		14.2900 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		32.9183 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		32.9183 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 heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							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							1	(19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3803 (21)				
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4849	0.4754	0.4659	0.4183	0.4088	0.3613	0.3613	0.3518	0.3803	0.4088	0.4278	0.4469 (22b)
Effective ac	0.6176	0.6130	0.6085	0.5875	0.5836	0.5653	0.5653	0.5619	0.5723	0.5836	0.5915	0.5998 (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)			13.0300	1.3258	17.2746		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.1800	12.5316		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			162.5100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		41.8932		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9775 (36)					
Total fabric heat loss						(33) + (36) =	50.8707 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.9424	Feb 37.6619	Mar 37.3870	Apr 36.0958	May 35.8542	Jun 34.7296	Jul 34.7296	Aug 34.5213	Sep 35.1628	Oct 35.8542	Nov 36.3429	Dec 36.8539 (38)
Heat transfer coeff	88.8131	88.5326	88.2577	86.9665	86.7249	85.6003	85.6003	85.3921	86.0335	86.7249	87.2137	87.7246 (39)
Average = Sum(39)m / 12 =												86.9654 (39)
HLP	Jan 1.1401	Feb 1.1365	Mar 1.1330	Apr 1.1164	May 1.1133	Jun 1.0988	Jul 1.0988	Aug 1.0962	Sep 1.1044	Oct 1.1133	Nov 1.1196	Dec 1.1261 (40)
HLP (average)												1.1164 (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	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(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	381.1380	378.5576	364.6191	342.5619	320.2047	298.6467	285.0641	291.6329	303.2874	325.5542	351.0185	370.0930	(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
North				0.5700	10.6334	0.6300	0.7000			0.7700			1.8523 (74)
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	76.6412	149.8429	246.9553	361.0587	443.6655	454.7803	432.7129	370.8404	287.4555	177.8146	95.5381	63.0470	(83)
Total gains	457.7792	528.4005	611.5744	703.6206	763.8701	753.4271	717.7770	662.4733	590.7429	503.3688	446.5566	433.1400	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9113	61.1043	61.2946	62.2047	62.3779	63.1975	63.1975	63.3516	62.8792	62.3779	62.0284	61.6671	
alpha	5.0608	5.0736	5.0863	5.1470	5.1585	5.2132	5.2132	5.2234	5.1919	5.1585	5.1352	5.1111	
util living area	0.9982	0.9959	0.9877	0.9544	0.8595	0.6834	0.5159	0.5766	0.8405	0.9776	0.9962	0.9986	(86)
MIT	19.7605	19.9133	20.1828	20.5381	20.8180	20.9599	20.9923	20.9868	20.8820	20.5025	20.0697	19.7392	(87)
Th 2	19.9682	19.9711	19.9740	19.9875	19.9900	20.0018	20.0018	20.0040	19.9972	19.9900	19.9849	19.9796	(88)
util rest of house	0.9976	0.9945	0.9832	0.9376	0.8112	0.5942	0.4035	0.4600	0.7687	0.9663	0.9947	0.9982	(89)
MIT 2	18.3145	18.5395	18.9327	19.4465	19.8135	19.9755	19.9990	19.9986	19.9024	19.4071	18.7783	18.2914	(90)
Living area fraction	18.8736	19.0707	19.4161	19.8686	20.2019	20.3561	20.3830	20.3807	20.2811	19.8306	19.2776	18.8512	(91)
MIT	18.8736	19.0707	19.4161	19.8686	20.2019	20.3561	20.3830	20.3807	20.2811	19.8306	19.2776	18.8512	(92)
Temperature adjustment	18.8736	19.0707	19.4161	19.8686	20.2019	20.3561	20.3830	20.3807	20.2811	19.8306	19.2776	18.8512	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	456.2391	524.5767	599.3587	658.0525	628.2492	472.6635	321.0059	334.7648	467.5275	485.2639	443.5167	432.0324	(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	1294.3263	1254.5663	1139.9428	953.8973	737.3245	492.7277	323.8295	339.9166	531.7859	800.5255	1062.0531	1285.2694	(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	623.5368	490.5530	402.1946	213.0083	81.1520	0.0000	0.0000	0.0000	0.0000	234.5547	445.3462	634.8083	(98)
Space heating												3125.1538	(98)
Space heating per m2												40.1175	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3345.9891 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	623.5368	490.5530	402.1946	213.0083	81.1520	0.0000	0.0000	0.0000	0.0000	234.5547	445.3462	634.8083	(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)	667.5983	525.2173	430.6152	228.0602	86.8865	0.0000	0.0000	0.0000	0.0000	251.1292	476.8161	679.6663	(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	87.7148	87.4989	86.9825	85.7405	83.4796	80.3000	80.3000	80.3000	80.3000	85.8632	87.2250	80.3000	(216)
Fuel for water heating, kWh/month	228.6676	200.6927	210.0473	189.0002	187.9413	172.0825	164.8682	183.7894	185.8191	197.8828	207.9381	223.0783	(219)
Water heating fuel used												2351.8075	(219)
Annual totals kWh/year													
Space heating fuel - main system												3345.9891	(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)												350.1515	(232)
Total delivered energy for all uses												6122.9482	(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	3345.9891	0.2160	722.7336 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2351.8075	0.2160	507.9904 (264)
Space and water heating			1230.7241 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Total CO2, kg/m2/year			1451.3777 (272)
Emissions per m2 for space and water heating			15.7988 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3328 (272b)
Emissions per m2 for pumps and fans			0.4997 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7988 * 1.00) + 2.3328 + 0.4997, rounded to 2 d.p.			18.6300 (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					4.5700
Infiltration rate					0.3896 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3604 (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	0.4595	0.4505	0.4415	0.3965	0.3874	0.3424	0.3424	0.3334	0.3604	0.3874	0.4055	0.4235 (22b)
Effective ac	0.6056	0.6015	0.5975	0.5786	0.5751	0.5586	0.5586	0.5556	0.5649	0.5751	0.5822	0.5897 (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)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (28a)
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)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (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)						(28)...(30) + (32) + (32a)...(32e) =	14102.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							181.0361 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.3755 (36)
Total fabric heat loss						(33) + (36) =	55.8936 (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	37.2067	36.9549	36.7079	35.5482	35.3313	34.3212	34.3212	34.1341	34.7103	35.3313	35.7702	36.2291 (38)
Heat transfer coeff	93.1004	92.8485	92.6016	91.4418	91.2249	90.2148	90.2148	90.0278	90.6039	91.2249	91.6638	92.1227 (39)
Average = Sum(39)m / 12 =												91.4408 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1951	1.1919	1.1887	1.1738	1.1711	1.1581	1.1581	1.1557	1.1631	1.1711	1.1767	1.1826 (40)
HLP (average)												1.1738 (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 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)
(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	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(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	336.8830	335.5431	323.8207	304.5503	284.2228	265.2663	253.3610	257.1525	267.4153	286.8196	309.1329	326.5995	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF			Access factor Table 6d	Gains W
North					0.5700	10.6334		0.6200		0.7000			0.7700	1.8229 (74)
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	75.4247	147.4644	243.0354	355.3276	436.6231	447.5616	425.8444	364.9541	282.8927	174.9921	94.0216	62.0462	(83)	
Total gains	412.3077	483.0075	566.8561	659.8779	720.8459	712.8279	679.2054	622.1066	550.3080	461.8117	403.1545	388.6457	(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	42.0774	42.1915	42.3040	42.8406	42.9424	43.4232	43.4232	43.5135	43.2368	42.9424	42.7368	42.5239	
alpha	3.8052	3.8128	3.8203	3.8560	3.8628	3.8949	3.8949	3.9009	3.8825	3.8628	3.8491	3.8349	
util living area	0.9953	0.9908	0.9782	0.9401	0.8536	0.7047	0.5521	0.6130	0.8426	0.9672	0.9918	0.9963	(86)
MIT	19.2539	19.4482	19.7956	20.2547	20.6424	20.8845	20.9662	20.9495	20.7517	20.2297	19.6603	19.2242	(87)
Th 2	19.9239	19.9265	19.9290	19.9410	19.9432	19.9537	19.9537	19.9556	19.9497	19.9432	19.9387	19.9340	(88)
util rest of house	0.9941	0.9885	0.9723	0.9230	0.8108	0.6212	0.4347	0.4951	0.7800	0.9548	0.9893	0.9953	(89)
MIT 2	18.3299	18.5252	18.8710	19.3269	19.6862	19.8919	19.9424	19.9370	19.7947	19.3120	18.7466	18.3079	(90)
Living area fraction	18.6871	18.8821	19.2285	19.6856	20.0559	20.2757	20.3383	20.3285	20.1648	19.6668	19.0999	18.6622	(91)
Temperature adjustment	18.6871	18.8821	19.2285	19.6856	20.0559	20.2757	20.3383	20.3285	20.1648	19.6668	19.0999	18.6622	(92)
adjusted MIT	18.6871	18.8821	19.2285	19.6856	20.0559	20.2757	20.3383	20.3285	20.1648	19.6668	19.0999	18.6622	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	409.0730	475.9534	548.3597	605.8320	588.1641	462.4579	325.7646	335.6846	437.2715	438.9994	397.7505	386.1965	(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	1339.4467	1298.2126	1178.6796	986.2560	762.2657	512.0306	337.2464	353.6733	549.4914	827.1183	1099.9542	1332.2962	(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	692.1981	552.5582	468.9580	273.9053	129.5315	0.0000	0.0000	0.0000	0.0000	288.7605	505.5867	703.8982	(98)
Space heating												3615.3965	(98)
Space heating per m2												46.4107	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	848.0192	667.5895	684.2109	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8282	0.8897	0.8600	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	702.3313	593.9845	588.4348	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	923.6086	882.4739	817.3212	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	159.3196	214.6361	170.2915	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									fC = cooled area / (4) =			544.2472 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	39.8299	53.6590	42.5729	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												136.0618 (107)
Energy for space heating												1.7466 (108)
Energy for space cooling												46.4107 (99)
Total												1.7466 (108)
Dwelling Fabric Energy Efficiency (DFEE)												48.1574 (109)
												48.2 (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										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3803 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22)				
Adj infilt rate	0.4849	0.4754	0.4659	0.4183	0.4088	0.3613	0.3613	0.3518	0.3803	0.4088	0.4278	0.4469	(22a)				
Effective ac	0.6176	0.6130	0.6085	0.5875	0.5836	0.5653	0.5653	0.5619	0.5723	0.5836	0.5915	0.5998	(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)			13.0300	1.3258	17.2746		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.1800	12.5316		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			162.5100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		41.8932		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9775 (36)					
Total fabric heat loss						(33) + (36) =	50.8707 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 37.9424	Feb 37.6619	Mar 37.3870	Apr 36.0958	May 35.8542	Jun 34.7296	Jul 34.7296	Aug 34.5213	Sep 35.1628	Oct 35.8542	Nov 36.3429	Dec 36.8539 (38)
Heat transfer coeff	88.8131	88.5326	88.2577	86.9665	86.7249	85.6003	85.6003	85.3921	86.0335	86.7249	87.2137	87.7246 (39)
Average = Sum(39)m / 12 =												86.9654 (39)
HLP	Jan 1.1401	Feb 1.1365	Mar 1.1330	Apr 1.1164	May 1.1133	Jun 1.0988	Jul 1.0988	Aug 1.0962	Sep 1.1044	Oct 1.1133	Nov 1.1196	Dec 1.1261 (40)
HLP (average)												1.1164 (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	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 (46)
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	19.8270	17.6102	14.3216	10.8424	8.1048	6.8424	7.3935	9.6103	12.8989	16.3781	19.1157	20.3781	(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	336.8830	335.5431	323.8207	304.5503	284.2228	265.2663	253.3610	257.1525	267.4153	286.8196	309.1329	326.5995	(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			
North				0.5700	10.6334	0.6300	0.7000	0.7700	1.8523 (74)			
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	76.6412	149.8429	246.9553	361.0587	443.6655	454.7803	432.7129	370.8404	287.4555	177.8146	95.5381	63.0470 (83)
Total gains	413.5242	485.3860	570.7760	665.6090	727.8882	720.0467	686.0739	627.9929	554.8708	464.6342	404.6710	389.6464 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	60.9113	61.1043	61.2946	62.2047	62.3779	63.1975	63.1975	63.3516	62.8792	62.3779	62.0284	61.6671	
alpha	5.0608	5.0736	5.0863	5.1470	5.1585	5.2132	5.2132	5.2234	5.1919	5.1585	5.1352	5.1111	
util living area	0.9989	0.9972	0.9908	0.9630	0.8774	0.7073	0.5378	0.6041	0.8654	0.9839	0.9976	0.9992	(86)
MIT	19.7075	19.8623	20.1363	20.5011	20.7962	20.9531	20.9907	20.9837	20.8621	20.4602	20.0198	19.6869	(87)
Th 2	19.9682	19.9711	19.9740	19.9875	19.9900	20.0018	20.0018	20.0040	19.9972	19.9900	19.9849	19.9796	(88)
util rest of house	0.9985	0.9962	0.9874	0.9488	0.8324	0.6178	0.4216	0.4840	0.7988	0.9755	0.9966	0.9989	(89)
MIT 2	18.7862	18.9430	19.2174	19.5839	19.8528	19.9804	19.9994	19.9993	19.9193	19.5517	19.1115	18.7747	(90)
Living area fraction									fLA = Living area / (4) =			0.3866	(91)
MIT	19.1425	19.2984	19.5727	19.9385	20.2176	20.3565	20.3827	20.3799	20.2838	19.9030	19.4627	19.1274	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1425	19.2984	19.5727	19.9385	20.2176	20.3565	20.3827	20.3799	20.2838	19.9030	19.4627	19.1274	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9981	0.9954	0.9857	0.9480	0.8437	0.6513	0.4669	0.5309	0.8204	0.9745	0.9959	0.9986	(94)
Useful gains	412.7200	483.1388	562.6215	630.9692	614.1386	468.9704	320.3563	333.4012	455.1940	452.8015	403.0179	389.0881	(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	1318.2049	1274.7318	1153.7682	959.9806	738.6847	492.7564	323.8004	339.8526	532.0144	806.7988	1078.1942	1309.4998	(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	673.6808	531.9505	439.8132	236.8882	92.6623	0.0000	0.0000	0.0000	0.0000	263.3740	486.1269	684.7863	(98)
Space heating												3409.2822	(98)
Space heating per m2										(98) / (4) =		43.7649	(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	804.6430	633.4424	648.9797	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8939	0.9444	0.9212	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	719.2732	598.2307	597.8343	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	932.0461	890.5019	824.2014	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	153.1965	217.4498	168.4171	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												539.0634	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.2991	54.3624	42.1043	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												134.7658 (107)
Space cooling per m2												1.7300 (108)
Energy for space heating												43.7649 (99)
Energy for space cooling												1.7300 (108)
Total												45.4948 (109)
Target Fabric Energy Efficiency (TFEE)												52.3 (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					4.5700
Infiltration rate					0.3896 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3604 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3784	0.3514	0.3604	0.3424	0.3424	0.3334	0.3244	0.3154	0.3063	0.3334	0.3154	0.3334 (22b)
Effective ac	0.5716	0.5617	0.5649	0.5586	0.5586	0.5556	0.5526	0.5497	0.5469	0.5556	0.5497	0.5556 (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)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (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)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (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) = 14453.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 185.5361 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.3755 (36)
Total fabric heat loss (33) + (36) = 55.8936 (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	35.1193	34.5132	34.7103	34.3212	34.3212	34.1341	33.9521	33.7750	33.6029	34.1341	33.7750	34.1341 (38)
Heat transfer coeff	91.0129	90.4068	90.6039	90.2148	90.2148	90.0278	89.8457	89.6686	89.4965	90.0278	89.6686	90.0278 (39)
Average = Sum(39)m / 12 =												90.1013 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1683	1.1605	1.1631	1.1581	1.1581	1.1557	1.1533	1.1511	1.1489	1.1557	1.1511	1.1557 (40)
HLP (average)												1.1566 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.4218 (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	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(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	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(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
North				0.5700	13.4839		0.6200		0.7000		0.7700		2.3116 (74)
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	96.7205	160.8996	266.6976	390.7584	454.9668	505.9889	477.9021	420.6755	327.3775	205.8728	120.1821		78.2020 (83)
Total gains	644.4896	704.3251	789.0899	880.5832	911.4977	932.6821	887.1546	838.1163	763.5583	674.8304	625.5520		611.0736 (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	44.1124	44.4081	44.3115	44.5026	44.5026	44.5951	44.6854	44.7737	44.8598	44.5951	44.7737	44.5951
alpha	3.9408	3.9605	3.9541	3.9668	3.9668	3.9730	3.9790	3.9849	3.9907	3.9730	3.9849	3.9730
util living area	0.9776	0.9676	0.9361	0.8583	0.7245	0.5259	0.3890	0.4097	0.6646	0.8841	0.9603	0.9806 (86)
MIT	19.7405	19.8853	20.2001	20.5743	20.8391	20.9657	20.9920	20.9904	20.9146	20.5953	20.1311	19.7278 (87)
Th 2	19.9454	19.9517	19.9497	19.9537	19.9537	19.9556	19.9575	19.9593	19.9611	19.9556	19.9593	19.9556 (88)
util rest of house	0.9722	0.9599	0.9207	0.8251	0.6634	0.4389	0.2879	0.3040	0.5789	0.8480	0.9491	0.9759 (89)
MIT 2	18.3049	18.5168	18.9616	19.4743	19.8038	19.9339	19.9546	19.9558	19.8972	19.5171	18.8781	18.2941 (90)
Living area fraction	18.8600	19.0459	19.4405	19.8996	20.2041	20.3329	20.3557	20.3558	20.2906	19.9340	19.3626	18.8485 (92)
MIT	18.8600	19.0459	19.4405	19.8996	20.2041	20.3329	20.3557	20.3558	20.2906	19.9340	19.3626	18.8485 (92)
Temperature adjustment	18.7100	18.8959	19.2905	19.7496	20.0541	20.1829	20.2057	20.2058	20.1406	19.7840	19.2126	-0.1500
adjusted MIT	18.7100	18.8959	19.2905	19.7496	20.0541	20.1829	20.2057	20.2058	20.1406	19.7840	19.2126	18.6985 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9636	0.9498	0.9088	0.8177	0.6698	0.4585	0.3124	0.3295	0.5948	0.8410	0.9386	0.9680 (94)
Useful gains	621.0410	668.9486	717.1298	720.0415	610.4855	427.6048	277.1088	276.1814	454.1494	567.5305	587.1707	591.5397 (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	1256.8858	1229.1635	1113.5665	924.6696	681.4919	439.5933	279.0327	278.4960	486.9146	754.7898	1014.3819	1233.2438 (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	473.0685	376.4644	294.9489	147.3322	52.8288	0.0000	0.0000	0.0000	0.0000	139.3209	307.5921	477.4278 (98)
Space heating												2268.9837 (98)
RHI space heating demand												2269 (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					4.5700
Infiltration rate					0.3896 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3604 (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	0.4595	0.4505	0.4415	0.3965	0.3874	0.3424	0.3424	0.3334	0.3604	0.3874	0.4055	0.4235 (22b)
Effective ac	0.6056	0.6015	0.5975	0.5786	0.5751	0.5586	0.5586	0.5556	0.5649	0.5751	0.5822	0.5897 (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)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (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)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (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) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (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	37.2067	36.9549	36.7079	35.5482	35.3313	34.3212	34.3212	34.1341	34.7103	35.3313	35.7702	36.2291 (38)
Heat transfer coeff	93.1004	92.8485	92.6016	91.4418	91.2249	90.2148	90.2148	90.0278	90.6039	91.2249	91.6638	92.1227 (39)
Average = Sum(39)m / 12 =												91.4408 (39)
HLP	1.1951	1.1919	1.1887	1.1738	1.1711	1.1581	1.1581	1.1557	1.1631	1.1711	1.1767	1.1826 (40)
HLP (average)												1.1738 (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 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	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(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	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(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	
North					0.5700	10.6334	0.6200	0.7000	0.7700		1.8229 (74)	
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	75.4247	147.4644	243.0354	355.3276	436.6231	447.5616	425.8444	364.9541	282.8927	174.9921	94.0216	62.0462 (83)
Total gains	623.1938	690.8899	765.4276	845.1525	893.1541	874.2548	835.0969	782.3949	719.0735	643.9497	599.3915	594.9178 (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	43.1233	43.2403	43.3556	43.9054	44.0099	44.5026	44.5026	44.5951	44.3115	44.0099	43.7991	43.5809
alpha	3.8749	3.8827	3.8904	3.9270	3.9340	3.9668	3.9668	3.9730	3.9541	3.9340	3.9199	3.9054
util living area	0.9825	0.9725	0.9484	0.8884	0.7763	0.6109	0.4619	0.5085	0.7389	0.9179	0.9718	0.9852 (86)
MIT	19.5874	19.7656	20.0742	20.4645	20.7664	20.9345	20.9831	20.9754	20.8583	20.4610	19.9590	19.5547 (87)
Th 2	19.9239	19.9265	19.9290	19.9410	19.9432	19.9537	19.9537	19.9556	19.9497	19.9432	19.9387	19.9340 (88)
util rest of house	0.9782	0.9659	0.9358	0.8611	0.7237	0.5277	0.3582	0.4021	0.6626	0.8917	0.9638	0.9816 (89)
MIT 2	18.0690	18.3276	18.7699	19.3194	19.7102	19.9057	19.9460	19.9434	19.8313	19.3293	18.6180	18.0286 (90)
Living area fraction	18.6561	18.8836	19.2742	19.7621	20.1186	20.3035	20.3470	20.3425	20.2284	19.7669	19.1365	18.6186 (91)
MIT	18.5061	18.7336	19.1242	19.6121	19.9686	20.1535	20.1970	20.1925	20.0784	19.6169	18.9865	18.4686 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5061	18.7336	19.1242	19.6121	19.9686	20.1535	20.1970	20.1925	20.0784	19.6169	18.9865	18.4686 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9706	0.9563	0.9239	0.8513	0.7251	0.5444	0.3829	0.4271	0.6729	0.8818	0.9544	0.9747	(94)	
Useful gains	604.8780	660.6838	707.2132	719.4369	647.6358	475.9293	319.7927	334.1728	483.8720	567.8257	572.0385	579.8812	(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	1322.5925	1284.4282	1169.0235	979.5348	754.2982	501.0067	324.5035	341.4267	541.6650	822.5658	1089.5596	1314.4663	(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	533.9795	419.1562	343.5868	187.2705	79.3568	0.0000	0.0000	0.0000	0.0000	189.5267	372.6152	546.5313	(98)	
Space heating												2672.0231	(98)	
Space heating per m2												(98) / (4) =	34.3007	(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													2968.9145 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	533.9795	419.1562	343.5868	187.2705	79.3568	0.0000	0.0000	0.0000	0.0000	189.5267	372.6152	546.5313	(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)	593.3106	465.7291	381.7632	208.0783	88.1742	0.0000	0.0000	0.0000	0.0000	210.5852	414.0169	607.2570	(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	89.1780	89.1070	88.9432	88.5704	87.9002	86.7000	86.7000	86.7000	86.7000	88.5501	89.0106	86.7000	(216)
Fuel for water heating, kWh/month	191.3290	168.1074	175.3232	155.6786	152.1507	135.5563	128.0378	143.4793	144.1738	161.5929	172.6691	185.9471	(219)
Water heating fuel used												1914.0452	(219)
Annual totals kWh/year													
Space heating fuel - main system												2968.9145	(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)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												4719.8217	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2968.9145	3.4800	103.3182	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1914.0452	3.4800	66.6088	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	350.1515	13.1900	46.1850	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			268.4091	(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] =	0.9173 (257)
SAP value	87.2042	
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	2968.9145	0.2160	641.2855	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.0452	0.2160	413.4338	(264)
Space and water heating			1054.7193	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			970.0507	(272)
CO2 emissions per m2			12.4500	(273)
EI value			89.4234	
EI rating			89	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8811 = 3.950$, stars = 4
Water heating environmental impact	$0.216 / 0.8811 = 0.2452$, 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					4.5700
Infiltration rate					0.3896 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3604 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3784	0.3514	0.3604	0.3424	0.3424	0.3334	0.3244	0.3154	0.3063	0.3334	0.3154	0.3334 (22b)
Effective ac	0.5716	0.5617	0.5649	0.5586	0.5586	0.5556	0.5526	0.5497	0.5469	0.5556	0.5497	0.5556 (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)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum, (m ²)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (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) = 14453.2600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 185.5361 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 7.3755 (36)
Total fabric heat loss (33) + (36) = 55.8936 (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	35.1193	34.5132	34.7103	34.3212	34.3212	34.1341	33.9521	33.7750	33.6029	34.1341	33.7750	34.1341 (38)
Heat transfer coeff	91.0129	90.4068	90.6039	90.2148	90.2148	90.0278	89.8457	89.6686	89.4965	90.0278	89.6686	90.0278 (39)
Average = Sum(39)m / 12 =												90.1013 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1683	1.1605	1.1631	1.1581	1.1581	1.1557	1.1533	1.1511	1.1489	1.1557	1.1511	1.1557 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	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)
	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	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)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
												Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h	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)
												Total per year (kWh/year) = Sum(64)m = 1688.5811 (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	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(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	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(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
North			0.5700		13.4839		0.6200		0.7000		0.7700		2.3116 (74)
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	96.7205	160.8996	266.6976	390.7584	454.9668	505.9889	477.9021	420.6755	327.3775	205.8728	120.1821		78.2020 (83)
Total gains	644.4896	704.3251	789.0899	880.5832	911.4977	932.6821	887.1546	838.1163	763.5583	674.8304	625.5520		611.0736 (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	44.1124	44.4081	44.3115	44.5026	44.5026	44.5951	44.6854	44.7737	44.8598	44.5951	44.7737	44.5951
alpha	3.9408	3.9605	3.9541	3.9668	3.9668	3.9730	3.9790	3.9849	3.9907	3.9730	3.9849	3.9730
util living area	0.9776	0.9676	0.9361	0.8583	0.7245	0.5259	0.3890	0.4097	0.6646	0.8841	0.9603	0.9806 (86)
MIT	19.7405	19.8853	20.2001	20.5743	20.8391	20.9657	20.9920	20.9904	20.9146	20.5953	20.1311	19.7278 (87)
Th 2	19.9454	19.9517	19.9497	19.9537	19.9537	19.9556	19.9575	19.9593	19.9611	19.9556	19.9593	19.9556 (88)
util rest of house	0.9722	0.9599	0.9207	0.8251	0.6634	0.4389	0.2879	0.3040	0.5789	0.8480	0.9491	0.9759 (89)
MIT 2	18.3049	18.5168	18.9616	19.4743	19.8038	19.9339	19.9546	19.9558	19.8972	19.5171	18.8781	18.2941 (90)
Living area fraction	18.8600	19.0459	19.4405	19.8996	20.2041	20.3329	20.3557	20.3558	20.2906	19.9340	19.3626	18.8485 (91)
MIT	18.8600	19.0459	19.4405	19.8996	20.2041	20.3329	20.3557	20.3558	20.2906	19.9340	19.3626	18.8485 (92)
Temperature adjustment	18.7100	18.8959	19.2905	19.7496	20.0541	20.1829	20.2057	20.2058	20.1406	19.7840	19.2126	-0.1500
adjusted MIT	18.7100	18.8959	19.2905	19.7496	20.0541	20.1829	20.2057	20.2058	20.1406	19.7840	19.2126	18.6985 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9636	0.9498	0.9088	0.8177	0.6698	0.4585	0.3124	0.3295	0.5948	0.8410	0.9386	0.9680	(94)
Useful gains	621.0410	668.9486	717.1298	720.0415	610.4855	427.6048	277.1088	276.1814	454.1494	567.5305	587.1707	591.5397	(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	1256.8858	1229.1635	1113.5665	924.6696	681.4919	439.5933	279.0327	278.4960	486.9146	754.7898	1014.3819	1233.2438	(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	473.0685	376.4644	294.9489	147.3322	52.8288	0.0000	0.0000	0.0000	0.0000	139.3209	307.5921	477.4278	(98)
Space heating												2268.9837	(98)
Space heating per m2												29.1269	(99)
											(98) / (4) =		

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													2521.0929 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	473.0685	376.4644	294.9489	147.3322	52.8288	0.0000	0.0000	0.0000	0.0000	139.3209	307.5921	477.4278	(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)	525.6317	418.2938	327.7210	163.7025	58.6986	0.0000	0.0000	0.0000	0.0000	154.8010	341.7690	530.4754	(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	89.1010	89.0354	88.8307	88.3739	87.6096	86.7000	86.7000	86.7000	86.7000	88.2972	88.8729	86.7000	(216)
Fuel for water heating, kWh/month	191.4944	168.2427	175.5453	156.0249	152.6555	135.5563	128.0378	143.4793	144.1738	162.0557	172.9366	186.1226	(219)
Water heating fuel used												1916.3248	(219)
Annual totals kWh/year													
Space heating fuel - main system												2521.0929	(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)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4194.4700	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2521.0929	3.9200	98.8268	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1916.3248	3.9200	75.1199	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	350.1515	16.9600	59.3857	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	16.9600	-113.3096	(252)
Total energy cost			220.7428	(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	2521.0929	0.2160	544.5561	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.3248	0.2160	413.9262	(264)
Space and water heating			958.4822	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	0.5190	-346.7435	(269)
Total kg/year			832.3923	(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	2521.0929	1.2200	3075.7334	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1916.3248	1.2200	2337.9162	(264)
Space and water heating			5413.6496	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	350.1515	3.0700	1074.9652	(268)
Energy saving/generation technologies				
PV Unit	-668.0993	3.0700	-2051.0649	(269)
Primary energy kWh/year			4667.8000	(272)
Primary energy kWh/m2/year			59.9204	(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 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 30	-188 kg (22.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30 2.42 kg/m²	B 88	B 91
Total Savings	£30 2.42 kg/m²		

Potential energy efficiency rating: B 88
Potential environmental impact rating: B 91

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	£72	£81	-£8
Mains gas	£262	£223	£39
Space heating	£200	£200	£0
Water heating	£75	£45	£30
Lighting	£59	£59	£0
Generated (PV)	-£113	-£113	£0
Total cost of fuels	£221	£191	£31
Total cost of uses	£221	£191	£30
Delivered energy	54 kWh/m²	42 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	8 kg/m²	2 kg/m²
Primary energy	60 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					4.5700
Infiltration rate					0.3896 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3604 (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	0.4595	0.4505	0.4415	0.3965	0.3874	0.3424	0.3424	0.3334	0.3604	0.3874	0.4055	0.4235 (22b)
Effective ac	0.6056	0.6015	0.5975	0.5786	0.5751	0.5586	0.5586	0.5556	0.5649	0.5751	0.5822	0.5897 (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)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (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)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (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) = 14453.2600 (34)
185.5361 (35)
7.3755 (36)
(33) + (36) = 55.8936 (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	37.2067	36.9549	36.7079	35.5482	35.3313	34.3212	34.3212	34.1341	34.7103	35.3313	35.7702	36.2291 (38)
Heat transfer coeff	93.1004	92.8485	92.6016	91.4418	91.2249	90.2148	90.2148	90.0278	90.6039	91.2249	91.6638	92.1227 (39)
Average = Sum(39)m / 12 =												91.4408 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1951	1.1919	1.1887	1.1738	1.1711	1.1581	1.1581	1.1557	1.1631	1.1711	1.1767	1.1826 (40)
HLP (average)												1.1738 (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	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(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	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(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
North					0.5700	10.6334	0.6200	0.7000			0.7700			1.8229 (74)
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	75.4247	147.4644	243.0354	355.3276	436.6231	447.5616	425.8444	364.9541	282.8927	174.9921	94.0216	62.0462 (83)		
Total gains	623.1938	690.8899	765.4276	845.1525	893.1541	874.2548	835.0969	782.3949	719.0735	643.9497	599.3915	594.9178 (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	43.1233	43.2403	43.3556	43.9054	44.0099	44.5026	44.5026	44.5951	44.3115	44.0099	43.7991	43.5809
alpha	3.8749	3.8827	3.8904	3.9270	3.9340	3.9668	3.9668	3.9730	3.9541	3.9340	3.9199	3.9054
util living area	0.9825	0.9725	0.9484	0.8884	0.7763	0.6109	0.4619	0.5085	0.7389	0.9179	0.9718	0.9852 (86)
MIT	19.5874	19.7656	20.0742	20.4645	20.7664	20.9345	20.9831	20.9754	20.8583	20.4610	19.9590	19.5547 (87)
Th 2	19.9239	19.9265	19.9290	19.9410	19.9432	19.9537	19.9537	19.9556	19.9497	19.9432	19.9387	19.9340 (88)
util rest of house	0.9782	0.9659	0.9358	0.8611	0.7237	0.5277	0.3582	0.4021	0.6626	0.8917	0.9638	0.9816 (89)
MIT 2	18.0690	18.3276	18.7699	19.3194	19.7102	19.9057	19.9460	19.9434	19.8313	19.3293	18.6180	18.0286 (90)
Living area fraction	fLA = Living area / (4) =											0.3866 (91)
MIT	18.6561	18.8836	19.2742	19.7621	20.1186	20.3035	20.3470	20.3425	20.2284	19.7669	19.1365	18.6186 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5061	18.7336	19.1242	19.6121	19.9686	20.1535	20.1970	20.1925	20.0784	19.6169	18.9865	18.4686 (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	0.9706	0.9563	0.9239	0.8513	0.7251	0.5444	0.3829	0.4271	0.6729	0.8818	0.9544	0.9747	(94)
Useful gains	604.8780	660.6838	707.2132	719.4369	647.6358	475.9293	319.7927	334.1728	483.8720	567.8257	572.0385	579.8812	(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	1322.5925	1284.4282	1169.0235	979.5348	754.2982	501.0067	324.5035	341.4267	541.6650	822.5658	1089.5596	1314.4663	(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	533.9795	419.1562	343.5868	187.2705	79.3568	0.0000	0.0000	0.0000	0.0000	189.5267	372.6152	546.5313	(98)
Space heating												2672.0231	(98)
Space heating per m2											(98) / (4) =	34.3007	(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													2968.9145 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	533.9795	419.1562	343.5868	187.2705	79.3568	0.0000	0.0000	0.0000	0.0000	189.5267	372.6152	546.5313	(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)	593.3106	465.7291	381.7632	208.0783	88.1742	0.0000	0.0000	0.0000	0.0000	210.5852	414.0169	607.2570	(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	89.2694	89.2977	89.3149	89.3397	89.3391	86.7000	86.7000	86.7000	86.7000	88.9012	89.1486	86.7000	(216)
(217)m	89.2694	89.2977	89.3149	89.3397	89.3391	86.7000	86.7000	86.7000	86.7000	88.9012	89.1486	89.2855	(217)
Fuel for water heating, kWh/month	163.8520	122.2384	97.0997	50.5099	21.4284	5.6058	0.0000	31.4414	56.4257	102.5166	139.9986	162.9631	(219)
Water heating fuel used												954.0797	(219)
Annual totals kWh/year													
Space heating fuel - main system												2968.9145	(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)												350.1515	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)
Total delivered energy for all uses												3809.8562	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2968.9145	3.4800	103.3182	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	954.0797	3.4800	33.2020	(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	350.1515	13.1900	46.1850	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			241.5973	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.8256 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	88.4824
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	2968.9145	0.2160	641.2855 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	954.0797	0.2160	206.0812 (264)
Space and water heating			847.3668 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	350.1515	0.5190	181.7287 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total kg/year			788.6481 (272)
CO2 emissions per m2			10.1200 (273)
EI value			91.4012
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					4.5700
Infiltration rate					0.3896 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3604 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate	0.3784	0.3514	0.3604	0.3424	0.3424	0.3334	0.3244	0.3154	0.3063	0.3334	0.3154	0.3334 (22b)
Effective ac	0.5716	0.5617	0.5649	0.5586	0.5586	0.5556	0.5526	0.5497	0.5469	0.5556	0.5497	0.5556 (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)			7.2300	1.3258	9.5852		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1800	7.0110	75.0000	2921.2500 (28a)
100mm Knauf Supafil	84.6100	14.9900	69.6200	0.2500	17.4050	60.0000	4177.2000 (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)			162.5100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		48.5181		(33)
E-WM-28			39.2000	0.0000	0.0000	110.0000	4312.0000 (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) = 14453.2600 (34)
 185.5361 (35)
 7.3755 (36)
 (33) + (36) = 55.8936 (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	35.1193	34.5132	34.7103	34.3212	34.3212	34.1341	33.9521	33.7750	33.6029	34.1341	33.7750	34.1341 (38)
Heat transfer coeff	91.0129	90.4068	90.6039	90.2148	90.2148	90.0278	89.8457	89.6686	89.4965	90.0278	89.6686	90.0278 (39)
Average = Sum(39)m / 12 =												90.1013 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1683	1.1605	1.1631	1.1581	1.1581	1.1557	1.1533	1.1511	1.1489	1.1557	1.1511	1.1557 (40)
HLP (average)												1.1566 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy
 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 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	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												1208.1510 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												2029.6937 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.4065 (H8)	
Utilisation factor												0.5088 (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												-871.5756 (H17)	
Solar input	-28.4329	-40.4298	-69.4891	-93.7569	-110.1231	-117.6288	-115.1551	-103.0673	-80.6946	-55.7895	-33.6286	-23.3801 (63)	
	Solar input (sum of months) = Sum(63)m =											-871.5756 (63)	
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)	
	Total per year (kWh/year) = Sum(64)m =											821.2534 (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	49.5676	44.0255	35.8039	27.1059	20.2620	17.1060	18.4836	24.0257	32.2473	40.9453	47.7893	50.9452	(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	547.7691	543.4255	522.3923	489.8249	456.5309	426.6932	409.2524	417.4408	436.1808	468.9576	505.3699	532.8716	(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
North				0.5700	13.4839		0.6200		0.7000		0.7700		2.3116 (74)
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	96.7205	160.8996	266.6976	390.7584	454.9668	505.9889	477.9021	420.6755	327.3775	205.8728	120.1821		78.2020 (83)
Total gains	644.4896	704.3251	789.0899	880.5832	911.4977	932.6821	887.1546	838.1163	763.5583	674.8304	625.5520		611.0736 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9a, 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	44.1124	44.4081	44.3115	44.5026	44.5026	44.5951	44.6854	44.7737	44.8598	44.9591	44.7737	44.5951
alpha	3.9408	3.9605	3.9541	3.9668	3.9668	3.9730	3.9790	3.9849	3.9907	3.9730	3.9849	3.9730
util living area	0.9776	0.9676	0.9361	0.8583	0.7245	0.5259	0.3890	0.4097	0.6646	0.8841	0.9603	0.9806 (86)
MIT	19.7405	19.8853	20.2001	20.5743	20.8391	20.9657	20.9920	20.9904	20.9146	20.5953	20.1311	19.7278 (87)
Th 2	19.9454	19.9517	19.9497	19.9537	19.9537	19.9556	19.9575	19.9593	19.9611	19.9556	19.9593	19.9556 (88)
util rest of house	0.9722	0.9599	0.9207	0.8251	0.6634	0.4389	0.2879	0.3040	0.5789	0.8480	0.9491	0.9759 (89)
MIT 2	18.3049	18.5168	18.9616	19.4743	19.8038	19.9339	19.9546	19.9558	19.8972	19.5171	18.8781	18.2941 (90)
Living area fraction									fLA = Living area / (4) =			0.3866 (91)
MIT	18.8600	19.0459	19.4405	19.8996	20.2041	20.3329	20.3557	20.3558	20.2906	19.9340	19.3626	18.8485 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7100	18.8959	19.2905	19.7496	20.0541	20.1829	20.2057	20.2058	20.1406	19.7840	19.2126	18.6985 (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	0.9636	0.9498	0.9088	0.8177	0.6698	0.4585	0.3124	0.3295	0.5948	0.8410	0.9386	0.9680	(94)
Useful gains	621.0410	668.9486	717.1298	720.0415	610.4855	427.6048	277.1088	276.1814	454.1494	567.5305	587.1707	591.5397	(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	1256.8858	1229.1635	1113.5665	924.6696	681.4919	439.5933	279.0327	278.4960	486.9146	754.7898	1014.3819	1233.2438	(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	473.0685	376.4644	294.9489	147.3322	52.8288	0.0000	0.0000	0.0000	0.0000	139.3209	307.5921	477.4278	(98)
Space heating												2268.9837	(98)
Space heating per m2												29.1269	(99)
											(98) / (4) =		

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													2521.0929 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	473.0685	376.4644	294.9489	147.3322	52.8288	0.0000	0.0000	0.0000	0.0000	139.3209	307.5921	477.4278	(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)	525.6317	418.2938	327.7210	163.7025	58.6986	0.0000	0.0000	0.0000	0.0000	154.8010	341.7690	530.4754	(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	89.2152	89.2354	89.2302	89.2173	88.9540	86.7000	86.7000	86.7000	86.7000	88.6994	89.0484	86.7000	(216)
(217)m	89.2152	89.2354	89.2302	89.2173	88.9540	86.7000	86.7000	86.7000	86.7000	88.6994	89.0484	89.2194	(217)
Fuel for water heating, kWh/month	159.3793	122.5587	96.8831	49.4616	26.5506	0.0000	0.0000	24.6013	51.1005	98.4235	134.8314	159.7210	(219)
Water heating fuel used												923.5110	(219)
Annual totals kWh/year													
Space heating fuel - main system												2521.0929	(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)													350.1515 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												3251.6562	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2521.0929	3.9200	98.8268	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	923.5110	3.9200	36.2016	(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	350.1515	16.9600	59.3857	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	16.9600	-113.3096	(252)
Total energy cost			190.3045	(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	2521.0929	0.2160	544.5561	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	923.5110	0.2160	199.4784	(264)
Space and water heating			744.0345	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	350.1515	0.5190	181.7287	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			643.8946 (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	2521.0929	1.2200	3075.7334 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	923.5110	1.2200	1126.6835 (264)
Space and water heating			4202.4169 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	350.1515	3.0700	1074.9652 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			3610.0672 (272)
Primary energy kWh/m2/year			46.3423 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace 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	185.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	245.76 (P1)
Transmission heat loss coefficient	55.89 (37)
Summer heat loss coefficient	301.65 (P2)

Overhangs

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

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
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	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	0.5700	87.1704	0.6200	0.7000	0.9000	17.4670
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:						566.2248
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	Jun	Jul	Aug	
Solar gains	609	566	497	(P3)
Internal gains	424	406	414	
Total summer gains	1033	972	911	(P5)

	Jun	Jul	Aug	
Summer gain/loss ratio	3.42	3.22	3.02	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 185.5)	0.70	0.70	0.70	
Threshold temperature	19.53	21.23	21.02	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature:	Slight
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