

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-174			Issued on Date	24/04/2019
Assessment Reference	As Built	Prop Type Ref	2302 - Mid (Op)		
Property	60, St Andrews Road, SOUTHAMPTON, SO32 2ST				
SAP Rating	87 B	DER	13.65	TER	17.16
Environmental	90 B	% DER<TER	20.44		
CO ₂ Emissions (t/year)	0.81	DFEE	39.36	TFEE	44.63
General Requirements Compliance	Pass	% DFEE<TFEE	11.81		
Assessor Details	Mr. Fraser Browning, Fraser Browning, Tel: 01884 242050, Fraser.browning@aessc.co.uk			Assessor ID	T511-0001
Client					

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

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DWELLING AS BUILT

Mid-Terrace House, total floor area 78 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.16 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.65 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 39.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.33 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 3.52 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

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

Secondary heating system: None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: No cylinder

Boiler interlock Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK
Based on:
Overshading:
Average
Windows facing East: 4.46 m², No overhang
Windows facing West: 8.00 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
Air permeability 3.5 m³/m²h
Photovoltaic array 0.54 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.5200
Infiltration rate					0.3371 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2866 (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	0.3654	0.3582	0.3510	0.3152	0.3081	0.2722	0.2722	0.2651	0.2866	0.3081	0.3224	0.3367 (22b)
Effective ac	0.5667	0.5642	0.5616	0.5497	0.5474	0.5371	0.5371	0.5351	0.5411	0.5474	0.5520	0.5567 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum, (m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 16447.4600 (34)
211.1356 (35)
7.8202 (36)
(33) + (36) = 45.1462 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.8208	34.6615	34.5055	33.7723	33.6351	32.9966	32.9966	32.8783	33.2425	33.6351	33.9126	34.2027 (38)
Heat transfer coeff	79.9670	79.8077	79.6516	78.9185	78.7813	78.1427	78.1427	78.0245	78.3887	78.7813	79.0588	79.3489 (39)
Average = Sum(39)m / 12 =												78.9178 (39)
HLP	1.0265	1.0245	1.0225	1.0131	1.0113	1.0031	1.0031	1.0016	1.0063	1.0113	1.0149	1.0186 (40)
HLP (average)												1.0131 (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)

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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 (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	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9978	17.7619	14.4449	10.9358	8.1746	6.9013	7.4571	9.6931	13.0100	16.5192	19.2804	20.5536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	371.2443	369.1080	355.7484	334.2649	312.4950	291.5338	277.9435	283.9246	294.9909	316.6839	341.5721	360.1973	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				4.4600	19.6403	0.6200	0.7000	0.7700	26.3454 (76)			
West				2.2000	19.6403	0.6200	0.7000	0.7700	12.9955 (80)			
West				5.8000	19.6403	0.6200	0.7000	0.7700	34.2609 (80)			
Solar gains	73.6018	143.9807	237.1157	345.8191	423.8143	433.8494	413.0423	354.7972	275.7754	170.8452	91.7728	60.5265 (83)
Total gains	444.8461	513.0887	592.8641	680.0840	736.3093	725.3832	690.9858	638.7218	570.7662	487.5291	433.3448	420.7238 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	57.1328	57.2468	57.3590	57.8919	57.9927	58.4666	58.4666	58.5552	58.2831	57.9927	57.7891	57.5778
alpha	4.8089	4.8165	4.8239	4.8595	4.8662	4.8978	4.8978	4.9037	4.8855	4.8662	4.8526	4.8385
util living area	0.9966	0.9927	0.9801	0.9359	0.8275	0.6505	0.4893	0.5468	0.8070	0.9660	0.9933	0.9974 (86)
MIT	19.7415	19.9055	20.1897	20.5495	20.8254	20.9599	20.9918	20.9863	20.8863	20.5070	20.0547	19.7093 (87)
Th 2	20.0613	20.0630	20.0646	20.0725	20.0739	20.0807	20.0807	20.0820	20.0781	20.0739	20.0710	20.0679 (88)
util rest of house	0.9957	0.9907	0.9743	0.9172	0.7810	0.5713	0.3911	0.4448	0.7394	0.9524	0.9911	0.9967 (89)
MIT 2	18.3723	18.6123	19.0248	19.5379	19.8984	20.0519	20.0772	20.0754	19.9814	19.4893	18.8365	18.3298 (90)
Living area fraction	18.9017	19.1123	19.4752	19.9291	20.2568	20.4030	20.4308	20.4276	20.3313	19.8828	19.3075	18.8632 (92)
MIT	18.9017	19.1123	19.4752	19.9291	20.2568	20.4030	20.4308	20.4276	20.3313	19.8828	19.3075	18.8632 (92)
Temperature adjustment	18.7517	18.9623	19.3252	19.7791	20.1068	20.2530	20.2808	20.2776	20.1813	19.7328	19.1575	-0.1500
adjusted MIT	18.7517	18.9623	19.3252	19.7791	20.1068	20.2530	20.2808	20.2776	20.1813	19.7328	19.1575	18.7132 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9937	0.9873	0.9683	0.9101	0.7828	0.5868	0.4129	0.4672	0.7478	0.9460	0.9880	0.9951 (94)
Useful gains	442.0600	506.5980	574.0460	618.9123	576.3990	425.6559	285.3215	298.4188	426.8311	461.1904	428.1392	418.6734 (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	1155.6576	1122.2806	1021.5491	858.5582	662.3013	441.7375	287.6297	302.5496	476.7031	719.4920	953.2520	1151.6052 (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	530.9166	413.7387	332.9423	172.5451	63.9113	0.0000	0.0000	0.0000	0.0000	192.1764	378.0812	545.3013 (98)
Space heating												2629.6129 (98)
Space heating per m2												(98) / (4) = 33.7563 (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													2921.7921	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	530.9166	413.7387	332.9423	172.5451	63.9113	0.0000	0.0000	0.0000	0.0000	192.1764	378.0812	545.3013	(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)	589.9073	459.7097	369.9359	191.7168	71.0125	0.0000	0.0000	0.0000	0.0000	213.5293	420.0902	605.8903	(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	89.1745	89.0985	88.9204	88.5037	87.7403	86.7000	86.7000	86.7000	86.7000	88.5613	89.0207	89.2080	(216)	
Fuel for water heating, kWh/month	191.3366	168.1234	175.3680	155.7959	152.4281	135.5563	128.0378	143.4793	144.1738	161.5723	172.6495	185.9500	(219)	
Water heating fuel used												1914.4711	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2921.7921	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													353.1679	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930			-392.1930	(233)
Total delivered energy for all uses													4872.2381	(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	2921.7921	0.2160	631.1071	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1914.4711	0.2160	413.5258	(264)
Space and water heating			1044.6329	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	353.1679	0.5190	183.2942	(268)
Energy saving/generation technologies				
PV Unit	-392.1930	0.5190	-203.5482	(269)
Total CO2, kg/year			1063.3038	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.6500	(273)

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

DER			13.6500	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			32.2783	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			32.2783	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000	/ (5) =	0.1611 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4111 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.8500 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3495 (21)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4456	0.4368	0.4281	0.3844	0.3757	0.3320	0.3320	0.3233	0.3495	0.3757	0.3931	0.4106	(22b)				
Effective ac	0.5993	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5522	0.5611	0.5706	0.5773	0.5843	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			12.4600	1.3258	16.5189		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.1800	5.5782		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			123.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		34.1841		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3737 (36)					
Total fabric heat loss						(33) + (36) =	42.5578 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	36.8186	36.5818	36.3497	35.2594	35.0554	34.1057	34.1057	33.9299	34.4715	35.0554	35.4681	35.8995 (38)
Heat transfer coeff	79.3765	79.1397	78.9075	77.8172	77.6132	76.6636	76.6636	76.4877	77.0294	77.6132	78.0259	78.4573 (39)
Average = Sum(39)m / 12 =												77.8162 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0190	1.0159	1.0129	0.9989	0.9963	0.9841	0.9841	0.9819	0.9888	0.9963	1.0016	1.0072 (40)
HLP (average)												0.9989 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	Jan 100.8897	Feb 97.2210	Mar 93.5523	Apr 89.8836	May 86.2148	Jun 82.5461	Jul 82.5461	Aug 86.2148	Sep 89.8836	Oct 93.5523	Nov 97.2210	Dec 100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)
Energy content (annual)										Total = Sum(45)m =		1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	44.7483	47.6732	44.3261	43.9341	40.7077	42.0646	43.9341	44.3261	47.6732	47.9446	50.9589 (61)
Solar input	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545 (64)
	62.4872	54.6966	56.8162	50.2246	48.5422	42.5872	40.5491	45.4467	45.9563	52.5615	56.3514	60.9175 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9978	17.7619	14.4449	10.9358	8.1746	6.9013	7.4571	9.6931	13.0100	16.5192	19.2804	20.5536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	83.9882	81.3937	76.3658	69.7564	65.2449	59.1489	54.5014	61.0843	63.8283	70.6472	78.2658	81.8784	(72)
Total internal gains	381.3088	378.7093	364.7425	342.6553	320.2745	298.7057	285.1278	291.7157	303.3985	325.6953	351.1832	370.2686	(73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East	4.4600				19.6403	0.6300	0.7000	0.7700	26.7703 (76)			
West	8.0000				19.6403	0.6300	0.7000	0.7700	48.0186 (80)			

Solar gains	74.7889	146.3030	240.9401	351.3968	430.6500	440.8469	419.7042	360.5197	280.2234	173.6008	93.2530	61.5028 (83)
Total gains	456.0977	525.0123	605.6827	694.0521	750.9245	739.5526	704.8320	652.2354	583.6219	499.2961	444.4362	431.7713 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.1527	68.3566	68.5577	69.5183	69.7010	70.5644	70.5644	70.7267	70.2294	69.7010	69.3324	68.9511	
alpha	5.5435	5.5571	5.5705	5.6346	5.6467	5.7043	5.7043	5.7151	5.6820	5.6467	5.6222	5.5967	
util living area	0.9982	0.9957	0.9862	0.9457	0.8322	0.6405	0.4748	0.5320	0.8079	0.9736	0.9961	0.9987	(86)
MIT	19.9251	20.0715	20.3238	20.6464	20.8799	20.9789	20.9967	20.9940	20.9255	20.6018	20.2047	19.9022	(87)
Th 2	20.0676	20.0701	20.0726	20.0842	20.0864	20.0966	20.0966	20.0985	20.0927	20.0864	20.0820	20.0774	(88)
util rest of house	0.9976	0.9943	0.9814	0.9272	0.7828	0.5596	0.3794	0.4316	0.7358	0.9612	0.9945	0.9983	(89)
MIT 2	18.6266	18.8420	19.2095	19.6724	19.9718	20.0829	20.0954	20.0960	20.0341	19.6207	19.0458	18.6004	(90)
Living area fraction	19.1287	19.3173	19.6404	20.0490	20.3229	20.4294	20.4439	20.4432	20.3788	20.0000	19.4939	19.1038	(91)
MIT	19.1287	19.3173	19.6404	20.0490	20.3229	20.4294	20.4439	20.4432	20.3788	20.0000	19.4939	19.1038	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1287	19.3173	19.6404	20.0490	20.3229	20.4294	20.4439	20.4432	20.3788	20.0000	19.4939	19.1038	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9968	0.9927	0.9786	0.9264	0.7966	0.5903	0.4164	0.4706	0.7604	0.9597	0.9931	0.9976	(94)
Ext temp.	454.6369	521.1948	592.6970	642.9471	598.2157	436.5519	293.4958	306.9544	443.8127	479.1645	441.3825	430.7382	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1177.0498	1140.9837	1036.8747	867.5839	669.2536	446.8988	294.6846	309.2553	483.6491	729.5656	967.0453	1169.3092	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	537.4751	416.4982	330.4682	161.7385	52.8522	0.0000	0.0000	0.0000	0.0000	186.2984	378.4772	549.4968	(98)
Space heating per m2												2613.3047	(98)
												33.5469	(99)

8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2797.9708 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	537.4751	416.4982	330.4682	161.7385	52.8522	0.0000	0.0000	0.0000	0.0000	186.2984	378.4772	549.4968	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	575.4552	445.9295	353.8204	173.1676	56.5870	0.0000	0.0000	0.0000	0.0000	199.4630	405.2218	588.3263	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	200.5754	175.6039	182.7045	162.0496	156.8926	138.1823	132.3891	147.5829	149.2128	169.9085	181.3739	195.8545	(64)
Efficiency of water heater	87.4121	87.1491	86.5253	85.0464	82.6262	80.3000	80.3000	80.3000	80.3000	85.2834	86.8606	87.5078	(217)
Fuel for water heating, kWh/month	229.4596	201.4982	211.1572	190.5427	189.8825	172.0825	164.8682	183.7894	185.8191	199.2281	208.8104	223.8137	(219)
Water heating fuel used												2360.9518	(219)
Annual totals kWh/year													
Space heating fuel - main system												2797.9708	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												353.1679	(232)
Total delivered energy for all uses												5587.0905	(238)

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2797.9708	0.2160	604.3617 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2360.9518	0.2160	509.9656 (264)
Space and water heating			1114.3273 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	353.1679	0.5190	183.2942 (268)
Total CO2, kg/m2/year			1336.5464 (272)
Emissions per m2 for space and water heating			14.3046 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3529 (272b)
Emissions per m2 for pumps and fans			0.4997 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.3046 * 1.00) + 2.3529 + 0.4997, rounded to 2 d.p.			17.1600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.5200
Infiltration rate					0.3371 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2866 (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	0.3654	0.3582	0.3510	0.3152	0.3081	0.2722	0.2722	0.2651	0.2866	0.3081	0.3224	0.3367 (22b)
Effective ac	0.5667	0.5642	0.5616	0.5497	0.5474	0.5371	0.5371	0.5351	0.5411	0.5474	0.5520	0.5567 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			9.0000	350.5500 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16096.9100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							206.6356 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8202 (36)
Total fabric heat loss						(33) + (36) =	45.1462 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.8208	34.6615	34.5055	33.7723	33.6351	32.9966	32.9966	32.8783	33.2425	33.6351	33.9126	34.2027 (38)
Heat transfer coeff	79.9670	79.8077	79.6516	78.9185	78.7813	78.1427	78.1427	78.0245	78.3887	78.7813	79.0588	79.3489 (39)
Average = Sum(39)m / 12 =												78.9178 (39)
HLP	1.0265	1.0245	1.0225	1.0131	1.0113	1.0031	1.0031	1.0016	1.0063	1.0113	1.0149	1.0186 (40)
HLP (average)												1.0131 (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 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	19.9978	17.7619	14.4449	10.9358	8.1746	6.9013	7.4571	9.6931	13.0100	16.5192	19.2804	20.5536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	42.7332	41.3792	38.5674	34.7448	32.2630	28.7685	25.7983	29.6040	30.9561	34.9126	39.3802	41.3848	(72)
Total internal gains	337.0538	335.6948	323.9441	304.6437	284.2926	265.3253	253.4247	257.2353	267.5264	286.9607	309.2976	326.7750	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				4.4600	19.6403	0.6200	0.7000	0.7700	26.3454 (76)			
West				2.2000	19.6403	0.6200	0.7000	0.7700	12.9955 (80)			
West				5.8000	19.6403	0.6200	0.7000	0.7700	34.2609 (80)			
Solar gains	73.6018	143.9807	237.1157	345.8191	423.8143	433.8494	413.0423	354.7972	275.7754	170.8452	91.7728	60.5265 (83)
Total gains	410.6556	479.6755	561.0598	650.4628	708.1069	699.1746	666.4670	612.0325	543.3018	457.8059	401.0703	387.3016 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	55.9151	56.0267	56.1365	56.6580	56.7567	57.2205	57.2205	57.3072	57.0409	56.7567	56.5575	56.3507	
alpha	4.7277	4.7351	4.7424	4.7772	4.7838	4.8147	4.8147	4.8205	4.8027	4.7838	4.7705	4.7567	
util living area	0.9974	0.9941	0.9830	0.9428	0.8409	0.6680	0.5054	0.5670	0.8258	0.9718	0.9948	0.9980	(86)
MIT	19.6718	19.8403	20.1336	20.5085	20.8025	20.9523	20.9899	20.9829	20.8671	20.4611	19.9934	19.6398	(87)
Th 2	20.0613	20.0630	20.0646	20.0725	20.0739	20.0807	20.0807	20.0820	20.0781	20.0739	20.0710	20.0679	(88)
util rest of house	0.9966	0.9924	0.9780	0.9259	0.7966	0.5888	0.4049	0.4628	0.7614	0.9603	0.9931	0.9975	(89)
MIT 2	18.8403	19.0094	19.3012	19.6704	19.9363	20.0568	20.0776	20.0762	19.9989	19.6325	19.1689	18.8136	(90)
Living area fraction	19.1618	19.3307	19.6230	19.9944	20.2712	20.4030	20.4303	20.4268	20.3346	19.9528	19.4877	19.1331	(91)
MIT	19.1618	19.3307	19.6230	19.9944	20.2712	20.4030	20.4303	20.4268	20.3346	19.9528	19.4877	19.1331	(92)
Temperature adjustment	19.1618	19.3307	19.6230	19.9944	20.2712	20.4030	20.4303	20.4268	20.3346	19.9528	19.4877	19.1331	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	408.8834	475.2220	547.0740	601.1748	571.3596	431.9096	295.7854	307.9130	424.3925	438.8023	397.7027	386.0228	(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	1188.4520	1151.6775	1045.2689	875.5553	675.2490	453.4635	299.3132	314.1865	488.7224	736.8282	979.3564	1184.9227	(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	579.9991	454.5781	370.6570	197.5540	77.2937	0.0000	0.0000	0.0000	0.0000	221.7312	418.7906	594.3816	(98)
Space heating												2914.9852	(98)
Space heating per m2												37.4196	(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	734.5418	578.2563	592.9862	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9028	0.9478	0.9276	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	663.1106	548.0663	550.0486	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	907.7287	867.6695	805.6565	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	176.1250	237.7848	190.1723	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												604.0822 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	44.0313	59.4462	47.5431	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												151.0205 (107)
Space cooling per m2												1.9386 (108)
Energy for space heating												37.4196 (99)
Energy for space cooling												1.9386 (108)
Total												39.3582 (109)
Dwelling Fabric Energy Efficiency (DFEE)												39.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1611 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4111 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3495 (21)		
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
Adj infilt rate	0.4456	0.4368	0.4281	0.3844	0.3757	0.3320	0.3320	0.3233	0.3495	0.3757	0.3931	0.4106	(22b)				
Effective ac	0.5993	0.5954	0.5916	0.5739	0.5706	0.5551	0.5551	0.5522	0.5611	0.5706	0.5773	0.5843	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			1.9600	1.0000	1.9600		(26)					
TER Opening Type (Uw = 1.40)			12.4600	1.3258	16.5189		(27)					
Jet Floor Lo			38.9500	0.1300	5.0635		(28a)					
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.1800	5.5782		(29a)					
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635		(30)					
Total net area of external elements Aum(A, m2)			123.3100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	34.1841		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3737 (36)					
Total fabric heat loss						(33) + (36) =	42.5578 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.8186	Feb 36.5818	Mar 36.3497	Apr 35.2594	May 35.0554	Jun 34.1057	Jul 34.1057	Aug 33.9299	Sep 34.4715	Oct 35.0554	Nov 35.4681	Dec 35.8995 (38)
Heat transfer coeff	79.3765	79.1397	78.9075	77.8172	77.6132	76.6636	76.6636	76.4877	77.0294	77.6132	78.0259	78.4573 (39)
Average = Sum(39)m / 12 =												77.8162 (39)
HLP	Jan 1.0190	Feb 1.0159	Mar 1.0129	Apr 0.9989	May 0.9963	Jun 0.9841	Jul 0.9841	Aug 0.9819	Sep 0.9888	Oct 0.9963	Nov 1.0016	Dec 1.0072 (40)
HLP (average)												0.9989 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4218 (42)
Average daily hot water use (litres/day)												91.7179 (43)
Daily hot water use	Jan 100.8897	Feb 97.2210	Mar 93.5523	Apr 89.8836	May 86.2148	Jun 82.5461	Jul 82.5461	Aug 86.2148	Sep 89.8836	Oct 93.5523	Nov 97.2210	Dec 100.8897 (44)
Energy conte	149.6165	130.8556	135.0312	117.7235	112.9585	97.4746	90.3245	103.6487	104.8866	122.2353	133.4293	144.8956 (45)
Energy content (annual)										Total = Sum(45)m =		1443.0801 (45)
Distribution loss (46)m = 0.15 x (45)m												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.7935	27.8068	28.6941	25.0162	24.0037	20.7134	19.1940	22.0254	22.2884	25.9750	28.3537	30.7903 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	121.0904	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	19.9978	17.7619	14.4449	10.9358	8.1746	6.9013	7.4571	9.6931	13.0100	16.5192	19.2804	20.5536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	214.9956	217.2266	211.6046	199.6360	184.5279	170.3283	160.8421	158.6111	164.2331	176.2017	191.3099	205.5095	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	35.1090	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	42.7332	41.3792	38.5674	34.7448	32.2630	28.7685	25.7983	29.6040	30.9561	34.9126	39.3802	41.3848	(72)
Total internal gains	337.0538	335.6948	323.9441	304.6437	284.2926	265.3253	253.4247	257.2353	267.5264	286.9607	309.2976	326.7750	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East					4.4600	19.6403	0.6300	0.7000			0.7700			26.7703 (76)
West					8.0000	19.6403	0.6300	0.7000			0.7700			48.0186 (80)
Solar gains	74.7889	146.3030	240.9401	351.3968	430.6500	440.8469	419.7042	360.5197	280.2234	173.6008	93.2530	61.5028	(83)	
Total gains	411.8427	481.9978	564.8842	656.0405	714.9426	706.1722	673.1290	617.7550	547.7498	460.5615	402.5505	388.2778	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	68.1527	68.3566	68.5577	69.5183	69.7010	70.5644	70.5644	70.7267	70.2294	69.7010	69.3324	68.9511	
alpha	5.5435	5.5571	5.5705	5.6346	5.6467	5.7043	5.7043	5.7151	5.6820	5.6467	5.6222	5.5967	
util living area	0.9989	0.9972	0.9900	0.9564	0.8536	0.6657	0.4962	0.5595	0.8372	0.9815	0.9976	0.9992	(86)
MIT	19.8709	20.0194	20.2767	20.6106	20.8616	20.9745	20.9959	20.9923	20.9095	20.5595	20.1537	19.8487	(87)
Th 2	20.0676	20.0701	20.0726	20.0842	20.0864	20.0966	20.0966	20.0985	20.0927	20.0864	20.0820	20.0774	(88)
util rest of house	0.9986	0.9962	0.9864	0.9409	0.8070	0.5837	0.3970	0.4551	0.7692	0.9723	0.9966	0.9990	(89)
MIT 2	19.0297	19.1799	19.4373	19.7705	19.9947	20.0851	20.0955	20.0963	20.0426	19.7286	19.3240	19.0156	(90)
Living area fraction									fLA = Living area / (4) =			0.3866	(91)
MIT	19.3550	19.5045	19.7619	20.0953	20.3299	20.4290	20.4437	20.4427	20.3778	20.0499	19.6448	19.3377	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.3550	19.5045	19.7619	20.0953	20.3299	20.4290	20.4437	20.4427	20.3778	20.0499	19.6448	19.3377	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	411.1065	479.8135	556.3543	617.3814	586.6121	434.2181	293.1740	306.2301	434.1858	447.5898	400.9419	387.7766	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1195.0103	1155.7935	1046.4618	871.1867	669.7935	446.8700	294.6684	309.2172	483.5721	733.4354	978.8202	1187.6644	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	583.2244	454.2586	364.6400	182.7398	61.8870	0.0000	0.0000	0.0000	0.0000	212.6692	416.0724	595.1165	(98)
Space heating												2870.6078	(98)
Space heating per m2												36.8499	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	720.6376	567.3104	581.3066	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.9321	0.9687	0.9530	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	671.7047	549.5302	554.0008	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	915.9077	875.4563	812.3452	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	175.8261	242.4890	192.2083	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												610.5234	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	43.9565	60.6223	48.0521	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											152.6308 (107)
Space cooling per m2											1.9593 (108)
Energy for space heating											36.8499 (99)
Energy for space cooling											1.9593 (108)
Total											38.8092 (109)
Target Fabric Energy Efficiency (TFEE)											44.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.5200
Infiltration rate					0.3371 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2866 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.3009	0.2794	0.2866	0.2722	0.2722	0.2651	0.2579	0.2507	0.2436	0.2651	0.2507	0.2651 (22b)
	0.5453	0.5390	0.5411	0.5371	0.5371	0.5351	0.5333	0.5314	0.5297	0.5351	0.5314	0.5351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 16447.4600 (34)
211.1356 (35)
7.8202 (36)
(33) + (36) = 45.1462 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	33.5011	33.1180	33.2425	32.9966	32.9966	32.8783	32.7632	32.6513	32.5425	32.8783	32.6513	32.8783 (38)
Heat transfer coeff	78.6473	78.2642	78.3887	78.1427	78.1427	78.0245	77.9094	77.7975	77.6887	78.0245	77.7975	78.0245 (39)
Average = Sum(39)m / 12 =												78.0710 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0096	1.0047	1.0063	1.0031	1.0031	1.0016	1.0001	0.9987	0.9973	1.0016	0.9987	1.0016 (40)
HLP (average)												1.0022 (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 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	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)
RHI water heating demand												
Heat gains from water heating, kWh/month												
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245	(65)

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

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)													
	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
East				4.4600	25.1925	0.6200	0.7000			0.7700			33.7932 (76)
West				2.2000	25.1925	0.6200	0.7000			0.7700			16.6693 (80)
West				5.8000	25.1925	0.6200	0.7000			0.7700			43.9464 (80)
Solar gains	94.4089	157.0960	260.0966	380.0377	441.2754	490.1088	463.1740	408.6618	318.9681	200.9605	117.3300	76.3139	(83)
Total gains	642.6050	700.9007	782.7973	870.0960	897.9808	916.9494	872.5857	826.3095	755.4267	670.2708	623.1116	609.6244	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	58.0915	58.3759	58.2831	58.4666	58.4666	58.5552	58.6417	58.7261	58.8083	58.5552	58.7261	58.5552
alpha	4.8728	4.8917	4.8855	4.8978	4.8978	4.9037	4.9094	4.9151	4.9206	4.9037	4.9151	4.9037
util living area	0.9816	0.9714	0.9362	0.8436	0.6868	0.4777	0.3469	0.3655	0.6187	0.8732	0.9634	0.9846 (86)
MIT	20.1003	20.2235	20.4835	20.7665	20.9326	20.9905	20.9984	20.9980	20.9687	20.7678	20.4056	20.0807 (87)
Th 2	20.0753	20.0794	20.0781	20.0807	20.0807	20.0820	20.0832	20.0844	20.0856	20.0820	20.0844	20.0820 (88)
util rest of house	0.9768	0.9641	0.9204	0.8086	0.6277	0.4040	0.2661	0.2806	0.5399	0.8350	0.9524	0.9804 (89)
MIT 2	18.9021	19.0811	19.4459	19.8248	20.0210	20.0764	20.0827	20.0838	20.0637	19.8374	19.3477	18.8792 (90)
Living area fraction	fLA = Living area / (4) = 0.3866 (91)											
MIT	19.3654	19.5228	19.8471	20.1889	20.3735	20.4298	20.4368	20.4373	20.4136	20.1971	19.7568	19.3437 (92)
Temperature adjustment	-0.1500											
adjusted MIT	19.2154	19.3728	19.6971	20.0389	20.2235	20.2798	20.2868	20.2873	20.2636	20.0471	19.6068	19.1937 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9710	0.9572	0.9127	0.8068	0.6373	0.4201	0.2841	0.2995	0.5559	0.8333	0.9453	0.9752	(94)
Useful gains	623.9692	670.8726	714.4803	702.0150	572.2687	385.2053	247.9070	247.4920	419.9259	558.5575	589.0346	594.5078	(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	1125.8649	1101.3954	995.3090	823.5391	603.5361	388.5490	248.2785	247.9601	432.2315	674.6892	910.7559	1107.4601	(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	373.4104	289.3114	208.9366	87.4974	23.2630	0.0000	0.0000	0.0000	0.0000	86.4020	231.6394	381.6366	(98)
Space heating												1682.0965	(98)
RHI space heating demand												1682	(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					3.5200
Infiltration rate					0.3371 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2866 (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	0.3654	0.3582	0.3510	0.3152	0.3081	0.2722	0.2722	0.2651	0.2866	0.3081	0.3224	0.3367 (22b)
Effective ac	0.5667	0.5642	0.5616	0.5497	0.5474	0.5371	0.5371	0.5351	0.5411	0.5474	0.5520	0.5567 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum(A, m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	16447.4600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							211.1356 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							7.8202 (36)
Total fabric heat loss						(33) + (36) =	45.1462 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.8208	34.6615	34.5055	33.7723	33.6351	32.9966	32.9966	32.8783	33.2425	33.6351	33.9126	34.2027 (38)
Heat transfer coeff	79.9670	79.8077	79.6516	78.9185	78.7813	78.1427	78.1427	78.0245	78.3887	78.7813	79.0588	79.3489 (39)
Average = Sum(39)m / 12 =												78.9178 (39)
HLP	1.0265	1.0245	1.0225	1.0131	1.0113	1.0031	1.0031	1.0016	1.0063	1.0113	1.0149	1.0186 (40)
HLP (average)												1.0131 (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 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	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	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				4.4600	19.6403		0.6200		0.7000		0.7700		26.3454 (76)
West				2.2000	19.6403		0.6200		0.7000		0.7700		12.9955 (80)
West				5.8000	19.6403		0.6200		0.7000		0.7700		34.2609 (80)
Solar gains	73.6018	143.9807	237.1157	345.8191	423.8143	433.8494	413.0423	354.7972	275.7754	170.8452	91.7728		60.5265 (83)
Total gains	621.7979	687.7854	759.8164	835.8775	880.5198	860.6899	822.4539	772.4450	712.2339	640.1555	597.5544		593.8370 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	57.1328	57.2468	57.3590	57.8919	57.9927	58.4666	58.4666	58.5552	58.2831	57.9927	57.7891	57.5778
alpha	4.8089	4.8165	4.8239	4.8595	4.8662	4.8978	4.8978	4.9037	4.8855	4.8662	4.8526	4.8385
util living area	0.9863	0.9765	0.9503	0.8795	0.7455	0.5633	0.4146	0.4588	0.7000	0.9140	0.9756	0.9888 (86)
MIT	19.9812	20.1344	20.3888	20.6891	20.8921	20.9783	20.9960	20.9936	20.9401	20.6685	20.2703	19.9460 (87)
Th 2	20.0613	20.0630	20.0646	20.0725	20.0739	20.0807	20.0807	20.0820	20.0781	20.0739	20.0710	20.0679 (88)
util rest of house	0.9828	0.9705	0.9377	0.8507	0.6927	0.4893	0.3297	0.3701	0.6261	0.8864	0.9683	0.9859 (89)
MIT 2	18.7197	18.9413	19.3037	19.7189	19.9708	20.0659	20.0791	20.0791	20.0311	19.7030	19.1454	18.6737 (90)
Living area fraction	19.2075	19.4027	19.7232	20.0940	20.3270	20.4187	20.4336	20.4327	20.3825	fLA = Living area / (4) =		0.3866 (91)
MIT	19.2075	19.4027	19.7232	20.0940	20.3270	20.4187	20.4336	20.4327	20.3825	20.0763	19.5803	19.1656 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0575	19.2527	19.5732	19.9440	20.1770	20.2687	20.2836	20.2827	20.2325	19.9263	19.4303	19.0156 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9777	0.9639	0.9297	0.8462	0.6990	0.5048	0.3487	0.3898	0.6393	0.8813	0.9618	0.9815	(94)
Useful gains	607.9603	662.9534	706.3807	707.3190	615.4778	434.4877	286.7507	301.0653	455.3145	564.1410	574.7410	582.8416	(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	1180.1118	1145.4522	1041.3029	871.5757	667.8320	442.9646	287.8467	302.9424	480.7223	734.7398	974.8220	1175.6041	(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	425.6807	324.2392	249.1821	118.2648	38.9515	0.0000	0.0000	0.0000	0.0000	126.9255	288.0583	441.0153	(98)
Space heating												2012.3175	(98)
Space heating per m2												25.8321	(99)
	(98) / (4) =												

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													2235.9083	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	425.6807	324.2392	249.1821	118.2648	38.9515	0.0000	0.0000	0.0000	0.0000	126.9255	288.0583	441.0153	(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)	472.9786	360.2658	276.8690	131.4054	43.2795	0.0000	0.0000	0.0000	0.0000	141.0283	320.0647	490.0170	(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	89.0304	88.9304	88.7005	88.1930	87.4230	86.7000	86.7000	86.7000	86.7000	88.2205	88.8237	89.0733	(216)	
Fuel for water heating, kWh/month	191.6464	168.4414	175.8029	156.3448	152.9813	135.5563	128.0378	143.4793	144.1738	162.1964	173.0324	186.2311	(219)	
Water heating fuel used												1917.9239	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2235.9083	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													353.1679	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 908 * 1.00) =										-392.1930			-392.1930	(233)
Total delivered energy for all uses													4189.8071	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2235.9083	3.4800	77.8096 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1917.9239	3.4800	66.7438 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	353.1679	13.1900	46.5828 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-392.1930	13.1900	-51.7303 (252)
Total energy cost			269.2984 (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] =	0.9203 (257)
SAP value		87.1618
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	2235.9083	0.2160	482.9562 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1917.9239	0.2160	414.2716 (264)
Space and water heating			897.2277 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	353.1679	0.5190	183.2942 (268)
Energy saving/generation technologies			
PV Unit	-392.1930	0.5190	-203.5482 (269)
Total kg/year			915.8987 (272)
CO2 emissions per m2			11.7600 (273)
EI value			90.0138
EI rating			90 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
 $0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
 $3.48 / 0.8793 = 3.958$, stars = 4
 $0.216 / 0.8793 = 0.2456$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1611 (8)
Pressure test					Yes
Measured/design AP50					3.5200
Infiltration rate					0.3371 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2866 (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	0.3009	0.2794	0.2866	0.2722	0.2722	0.2651	0.2579	0.2507	0.2436	0.2651	0.2507	0.2651 (22b)
Effective ac	0.5453	0.5390	0.5411	0.5371	0.5371	0.5351	0.5333	0.5314	0.5297	0.5351	0.5314	0.5351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum, (m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 16447.4600 (34)
211.1356 (35)
7.8202 (36)
(33) + (36) = 45.1462 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	33.5011	33.1180	33.2425	32.9966	32.9966	32.8783	32.7632	32.6513	32.5425	32.8783	32.6513	32.8783 (38)
Heat transfer coeff	78.6473	78.2642	78.3887	78.1427	78.1427	78.0245	77.9094	77.7975	77.6887	78.0245	77.7975	78.0245 (39)
Average = Sum(39)m / 12 =												78.0710 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0096	1.0047	1.0063	1.0031	1.0031	1.0016	1.0001	0.9987	0.9973	1.0016	0.9987	1.0016 (40)
HLP (average)												1.0022 (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 09 Jan 2014

Energy content (annual)	Total = Sum (45)m = 1443.0801 (45)										
Distribution loss (46)m = 0.15 x (45)m											
22.4425	19.6283	20.2547	17.6585	16.9438	14.6212	13.5487	15.5473	15.7330	18.3353	20.0144	21.7343 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	21.0069	18.9400	20.9068	20.1617	20.7824	20.0527	20.6842	20.7478	20.1121	20.8553	20.2645 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum (63)m =	0.0000 (63)										
Output from w/h											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (64)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				4.4600	25.1925	0.6200	0.7000	0.7700	33.7932 (76)			
West				2.2000	25.1925	0.6200	0.7000	0.7700	16.6693 (80)			
West				5.8000	25.1925	0.6200	0.7000	0.7700	43.9464 (80)			
Solar gains	94.4089	157.0960	260.0966	380.0377	441.2754	490.1088	463.1740	408.6618	318.9681	200.9605	117.3300	76.3139 (83)
Total gains	642.6050	700.9007	782.7973	870.0960	897.9808	916.9494	872.5857	826.3095	755.4267	670.2708	623.1116	609.6244 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan 58.0915	Feb 58.3759	Mar 58.2831	Apr 58.4666	May 58.4666	Jun 58.5552	Jul 58.6417	Aug 58.7261	Sep 58.8083	Oct 58.5552	Nov 58.7261	Dec 58.5552
alpha	4.8728	4.8917	4.8855	4.8978	4.8978	4.9037	4.9094	4.9151	4.9206	4.9037	4.9151	4.9037
util living area	0.9816	0.9714	0.9362	0.8436	0.6868	0.4777	0.3469	0.3655	0.6187	0.8732	0.9634	0.9846 (86)
MIT	20.1003	20.2235	20.4835	20.7665	20.9326	20.9905	20.9984	20.9980	20.9687	20.7678	20.4056	20.0807 (87)
Th 2	20.0753	20.0794	20.0781	20.0807	20.0807	20.0820	20.0832	20.0844	20.0856	20.0820	20.0844	20.0820 (88)
util rest of house	0.9768	0.9641	0.9204	0.8086	0.6277	0.4040	0.2661	0.2806	0.5399	0.8350	0.9524	0.9804 (89)
MIT 2	18.9021	19.0811	19.4459	19.8248	20.0210	20.0764	20.0827	20.0838	20.0637	19.8374	19.3477	18.8792 (90)
Living area fraction	19.3654	19.5228	19.8471	20.1889	20.3735	20.4298	20.4368	20.4373	20.4136	20.1971	19.7568	19.3437 (91)
MIT	19.3654	19.5228	19.8471	20.1889	20.3735	20.4298	20.4368	20.4373	20.4136	20.1971	19.7568	19.3437 (92)
Temperature adjustment	19.2154	19.3728	19.6971	20.0389	20.2235	20.2798	20.2868	20.2873	20.2636	20.0471	19.6068	-0.1500
adjusted MIT	19.2154	19.3728	19.6971	20.0389	20.2235	20.2798	20.2868	20.2873	20.2636	20.0471	19.6068	19.1937 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	623.9692	670.8726	714.4803	702.0150	572.2687	385.2053	247.9070	247.4920	419.9259	558.5575	589.0346	594.5078	(94)
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	1125.8649	1101.3954	995.3090	823.5391	603.5361	388.5490	248.2785	247.9601	432.2315	674.6892	910.7559	1107.4601	(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	373.4104	289.3114	208.9366	87.4974	23.2630	0.0000	0.0000	0.0000	0.0000	86.4020	231.6394	381.6366	(98)
Space heating												1682.0965	(98)
Space heating per m2												21.5930	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1868.9962	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	373.4104	289.3114	208.9366	87.4974	23.2630	0.0000	0.0000	0.0000	0.0000	86.4020	231.6394	381.6366	(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)	414.9004	321.4571	232.1517	97.2193	25.8477	0.0000	0.0000	0.0000	0.0000	96.0022	257.3771	424.0406	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823	(64)	
Efficiency of water heater (217)m	88.9383	88.8464	88.5594	87.9520	87.1736	86.7000	86.7000	86.7000	86.7000	87.9136	88.6541	88.9740	(216)	
Fuel for water heating, kWh/month	191.8447	168.6006	176.0829	156.7733	153.4190	135.5563	128.0378	143.4793	144.1738	162.7627	173.3635	186.4391	(219)	
Water heating fuel used												1920.5331	(219)	
Annual totals kWh/year														
Space heating fuel - main system												1868.9962	(211)	
Space heating fuel - secondary												0.0000	(215)	
Electricity for pumps and fans:														
central heating pump												30.0000	(230c)	
main heating flue fan												45.0000	(230e)	
Total electricity for the above, kWh/year												75.0000	(231)	
Electricity for lighting (calculated in Appendix L)												353.1679	(232)	
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.54 * 1031 * 1.00) =										-445.3995		-445.3995	(233)	
Total delivered energy for all uses												3772.2976	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1868.9962	3.9200	73.2646	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1920.5331	3.9200	75.2849	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Energy for lighting	353.1679	16.9600	59.8973	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-445.3995	16.9600	-75.5398	(252)
Total energy cost			233.6271	(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	1868.9962	0.2160	403.7032	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1920.5331	0.2160	414.8351	(264)
Space and water heating			818.5383	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	353.1679	0.5190	183.2942	(268)
Energy saving/generation technologies				
PV Unit	-445.3995	0.5190	-231.1624	(269)
Total kg/year			809.5951	(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	1868.9962	1.2200	2280.1753	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1920.5331	1.2200	2343.0503	(264)
Space and water heating			4623.2256	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	353.1679	3.0700	1084.2255	(268)
Energy saving/generation technologies				
PV Unit	-445.3995	3.0700	-1367.3766	(269)
Primary energy kWh/year			4570.3246	(272)
Primary energy kWh/m2/year			58.6691	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 31	-189 kg (23.3%)

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

Fuel prices for cost data on this page from database revision number 441 TEST (27 Mar 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£73	£81	-£8
Mains gas	£237	£198	£39
Space heating	£174	£174	£0
Water heating	£75	£45	£31
Lighting	£60	£60	£0
Generated (PV)	-£76	-£76	£0
Total cost of fuels	£234	£203	£31
Total cost of uses	£233	£203	£31
Delivered energy	48 kWh/m²	36 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	45 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					3.5200
Infiltration rate					0.3371 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2866 (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	0.3654	0.3582	0.3510	0.3152	0.3081	0.2722	0.2722	0.2651	0.2866	0.3081	0.3224	0.3367 (22b)
Effective ac	0.5667	0.5642	0.5616	0.5497	0.5474	0.5371	0.5371	0.5351	0.5411	0.5474	0.5520	0.5567 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum, (m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 16447.4600 (34)
211.1356 (35)
7.8202 (36)
(33) + (36) = 45.1462 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	34.8208	34.6615	34.5055	33.7723	33.6351	32.9966	32.9966	32.8783	33.2425	33.6351	33.9126	34.2027 (38)
Heat transfer coeff	79.9670	79.8077	79.6516	78.9185	78.7813	78.1427	78.1427	78.0245	78.3887	78.7813	79.0588	79.3489 (39)
Average = Sum(39)m / 12 =												78.9178 (39)
HLP	1.0265	1.0245	1.0225	1.0131	1.0113	1.0031	1.0031	1.0016	1.0063	1.0113	1.0149	1.0186 (40)
HLP (average)												1.0131 (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 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	-24.3537	-40.6394	-69.2135	-92.7598	-114.5969	-112.6670	-111.1781	-97.1368	-76.0776	-51.9521	-28.8870	-839.8420 (H17)
Solar input												-20.3799 (63)
Solar input (sum of months) = Sum(63)m =												-839.8420 (63)
Output from w/h	146.2697	109.1561	86.7245	45.1254	19.1439	4.8603	0.0000	27.2597	48.9211	91.1385	124.8068	145.5023 (64)
Total per year (kWh/year) = Sum(64)m =												848.9084 (64)
Heat gains from water heating, kWh/month	54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

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

Solar gains	73.6018	143.9807	237.1157	345.8191	423.8143	433.8494	413.0423	354.7972	275.7754	170.8452	91.7728	60.5265 (83)
Total gains	621.7979	687.7854	759.8164	835.8775	880.5198	860.6899	822.4539	772.4450	712.2339	640.1555	597.5544	593.8370 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
alpha	57.1328	57.2468	57.3590	57.8919	57.9927	58.4666	58.4666	58.5552	58.2831	57.9927	57.7891	57.5778
util living area	4.8089	4.8165	4.8239	4.8595	4.8662	4.8978	4.8978	4.9037	4.8855	4.8662	4.8526	4.8385
	0.9863	0.9765	0.9503	0.8795	0.7455	0.5633	0.4146	0.4588	0.7000	0.9140	0.9756	0.9888 (86)
MIT	19.9812	20.1344	20.3888	20.6891	20.8921	20.9783	20.9960	20.9936	20.9401	20.6685	20.2703	19.9460 (87)
Th 2	20.0613	20.0630	20.0646	20.0725	20.0739	20.0807	20.0807	20.0820	20.0781	20.0739	20.0710	20.0679 (88)
util rest of house	0.9828	0.9705	0.9377	0.8507	0.6927	0.4893	0.3297	0.3701	0.6261	0.8864	0.9683	0.9859 (89)
MIT 2	18.7197	18.9413	19.3037	19.7189	19.9708	20.0659	20.0791	20.0791	20.0311	19.7030	19.1454	18.6737 (90)
Living area fraction												0.3866 (91)
MIT	19.2075	19.4027	19.7232	20.0940	20.3270	20.4187	20.4336	20.4327	20.3825	20.0763	19.5803	19.1656 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.0575	19.2527	19.5732	19.9440	20.1770	20.2687	20.2836	20.2827	20.2325	19.9263	19.4303	19.0156 (93)

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	2235.9083	0.2160	482.9562 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	955.8774	0.2160	206.4695 (264)
Space and water heating			689.4257 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	353.1679	0.5190	183.2942 (268)
Energy saving/generation technologies			
PV Unit	-392.1930	0.5190	-203.5482 (269)
Total kg/year			734.0467 (272)
CO2 emissions per m2			9.4200 (273)
EI value			91.9966
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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					3.5200
Infiltration rate					0.3371 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2866 (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	0.3009	0.2794	0.2866	0.2722	0.2722	0.2651	0.2579	0.2507	0.2436	0.2651	0.2507	0.2651 (22b)
Effective ac	0.5453	0.5390	0.5411	0.5371	0.5371	0.5351	0.5333	0.5314	0.5297	0.5351	0.5314	0.5351 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid FD			1.9600	0.9000	1.7640		(26)
Windows (Uw = 1.40)			6.6600	1.3258	8.8295		(27)
French Door (Uw = 1.40)			5.8000	1.3258	7.6894		(27)
Jet Floor Lo			38.9500	0.1600	6.2320	75.0000	2921.2500 (28a)
100mm Knauf Supafil	45.4100	14.4200	30.9900	0.2500	7.7475	60.0000	1859.4000 (29a)
External Plane Ceiling	38.9500		38.9500	0.1300	5.0635	9.0000	350.5500 (30)
Total net area of external elements Aum, (m ²)			123.3100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		37.3259		(33)
E-WM-28			78.4000	0.0000	0.0000	110.0000	8624.0000 (32)
GF - Timber			48.4600			9.0000	436.1400 (32c)
1F - Timber			94.8800			9.0000	853.9200 (32c)
Internal Floor 1			38.9500			18.0000	701.1000 (32d)
Internal Ceiling 1			38.9500			18.0000	701.1000 (32e)

Heat capacity Cm = Sum(A x k)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
 Thermal bridges (Sum(L x Psi) calculated using Appendix K)
 Total fabric heat loss
 (28)...(30) + (32) + (32a)...(32e) = 16447.4600 (34)
 211.1356 (35)
 7.8202 (36)
 (33) + (36) = 45.1462 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	33.5011	33.1180	33.2425	32.9966	32.9966	32.8783	32.7632	32.6513	32.5425	32.8783	32.6513	32.8783 (38)
Heat transfer coeff	78.6473	78.2642	78.3887	78.1427	78.1427	78.0245	77.9094	77.7975	77.6887	78.0245	77.7975	78.0245 (39)
Average = Sum(39)m / 12 =												78.0710 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0096	1.0047	1.0063	1.0031	1.0031	1.0016	1.0001	0.9987	0.9973	1.0016	0.9987	1.0016 (40)
HLP (average)												1.0022 (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)

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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 (61)
Total heat required for water heating calculated for each month											
170.6235	149.7955	155.9380	137.8852	133.7409	117.5273	111.0087	124.3966	124.9987	143.0906	153.6938	165.8823 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-28.4329	-40.4298	-69.4891	-93.7569	-110.1231	-117.6288	-115.1551	-103.0673	-80.6946	-55.7895	-33.6286 (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)
Heat gains from water heating, kWh/month											
54.9992	48.2445	50.1246	44.1835	42.7543	37.4235	35.2040	39.6502	39.9028	45.8571	49.4314	53.4245 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	145.3084	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.9946	44.4047	36.1124	27.3394	20.4365	17.2534	18.6429	24.2327	32.5251	41.2981	48.2009	51.3841	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	320.8890	324.2188	315.8278	297.9642	275.4147	254.2213	240.0629	236.7330	245.1241	262.9876	285.5372	306.7305	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	51.9527	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	-96.8723	(71)
Water heating gains (Table 5)	73.9237	71.7924	67.3717	61.3660	57.4654	51.9770	47.3172	53.2932	55.4206	61.6358	68.6547	71.8071	(72)
Total internal gains	548.1961	543.8047	522.7007	490.0584	456.7055	426.8405	409.4117	417.6478	436.4586	469.3103	505.7816	533.3105	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				4.4600	25.1925		0.6200		0.7000		0.7700		33.7932 (76)
West				2.2000	25.1925		0.6200		0.7000		0.7700		16.6693 (80)
West				5.8000	25.1925		0.6200		0.7000		0.7700		43.9464 (80)
Solar gains	94.4089	157.0960	260.0966	380.0377	441.2754	490.1088	463.1740	408.6618	318.9681	200.9605	117.3300		76.3139 (83)
Total gains	642.6050	700.9007	782.7973	870.0960	897.9808	916.9494	872.5857	826.3095	755.4267	670.2708	623.1116		609.6244 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	58.0915	58.3759	58.2831	58.4666	58.4666	58.5552	58.6417	58.7261	58.8083	58.5552	58.7261	58.5552
alpha	4.8728	4.8917	4.8855	4.8978	4.8978	4.9037	4.9094	4.9151	4.9206	4.9037	4.9151	4.9037
util living area	0.9816	0.9714	0.9362	0.8436	0.6868	0.4777	0.3469	0.3655	0.6187	0.8732	0.9634	0.9846 (86)
MIT	20.1003	20.2235	20.4835	20.7665	20.9326	20.9905	20.9984	20.9980	20.9687	20.7678	20.4056	20.0807 (87)
Th 2	20.0753	20.0794	20.0781	20.0807	20.0807	20.0820	20.0832	20.0844	20.0856	20.0820	20.0844	20.0820 (88)
util rest of house	0.9768	0.9641	0.9204	0.8086	0.6277	0.4040	0.2661	0.2806	0.5399	0.8350	0.9524	0.9804 (89)
MIT 2	18.9021	19.0811	19.4459	19.8248	20.0210	20.0764	20.0827	20.0838	20.0637	19.8374	19.3477	18.8792 (90)
Living area fraction	19.3654	19.5228	19.8471	20.1889	20.3735	20.4298	20.4368	20.4373	20.4136	20.1971	19.7568	19.3437 (92)
Temperature adjustment	19.2154	19.3728	19.6971	20.0389	20.2235	20.2798	20.2868	20.2873	20.2636	20.0471	19.6068	19.1937 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9710	0.9572	0.9127	0.8068	0.6373	0.4201	0.2841	0.2995	0.5559	0.8333	0.9453	0.9752	(94)
Useful gains	623.9692	670.8726	714.4803	702.0150	572.2687	385.2053	247.9070	247.4920	419.9259	558.5575	589.0346	594.5078	(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	1125.8649	1101.3954	995.3090	823.5391	603.5361	388.5490	248.2785	247.9601	432.2315	674.6892	910.7559	1107.4601	(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	373.4104	289.3114	208.9366	87.4974	23.2630	0.0000	0.0000	0.0000	0.0000	86.4020	231.6394	381.6366	(98)
Space heating												1682.0965	(98)
Space heating per m2												(98) / (4) =	21.5930 (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													1868.9962 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	373.4104	289.3114	208.9366	87.4974	23.2630	0.0000	0.0000	0.0000	0.0000	86.4020	231.6394	381.6366	(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)	414.9004	321.4571	232.1517	97.2193	25.8477	0.0000	0.0000	0.0000	0.0000	96.0022	257.3771	424.0406	(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	89.0651	89.0700	89.0085	88.8660	88.3067	86.7000	86.7000	86.7000	86.7000	88.3106	88.8456	89.0782	(217)
(217)m	89.0651	89.0700	89.0085	88.8660	88.3067	86.7000	86.7000	86.7000	86.7000	88.3106	88.8456	89.0782	(217)
Fuel for water heating, kWh/month	159.6479	122.7863	97.1244	49.6572	26.7452	0.0000	0.0000	24.6013	51.1005	98.8568	135.1392	159.9742	(219)
Water heating fuel used												925.6331	(219)
Annual totals kWh/year													
Space heating fuel - main system												1868.9962	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													353.1679 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.54 * 1031 * 1.00) =									-445.3995			-445.3995	(233)
Total delivered energy for all uses												2827.3976	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1868.9962	3.9200	73.2646	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	925.6331	3.9200	36.2848	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	353.1679	16.9600	59.8973	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-445.3995	16.9600	-75.5398	(252)
Total energy cost			203.1070	(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	1868.9962	0.2160	403.7032	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	925.6331	0.2160	199.9367	(264)
Space and water heating			603.6399	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	353.1679	0.5190	183.2942	(268)
Energy saving/generation technologies				
PV Unit	-445.3995	0.5190	-231.1624	(269)

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Total kg/year 620.6467 (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	1868.9962	1.2200	2280.1753 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	925.6331	1.2200	1129.2723 (264)
Space and water heating			3409.4476 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	353.1679	3.0700	1084.2255 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			3510.0466 (272)
Primary energy kWh/m2/year			45.0584 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	East
Overshading	Average or unknown
Thermal mass parameter	211.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	245.76 (P1)
Transmission heat loss coefficient	45.15 (37)
Summer heat loss coefficient	290.91 (P2)

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

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

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

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