

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-132			Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	SHL3 - Mid (Op)		
Property	43, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE				
SAP Rating	87 B	DER	13.86	TER	17.73
Environmental	89 B	% DER<TER	21.83		
CO ₂ Emissions (t/year)	0.97	DFEE	45.56	TFEE	50.87
General Requirements Compliance	Pass	% DFEE<TFEE	10.44		
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 93 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) 17.73 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.86 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 45.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (max. 0.25)	0.14 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.06 (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 28 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): Not significant OK

Based on:

Overshading: Average
Windows facing East: 4.50 m², No overhang
Windows facing West: 6.06 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Photovoltaic array 0.81 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3380 (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) =	0.2873 (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	0.3663	0.3592	0.3520	0.3161	0.3089	0.2730	0.2730	0.2658	0.2873	0.3089	0.3232	0.3376 (22b)
Effective ac	0.5671	0.5645	0.5619	0.5499	0.5477	0.5373	0.5373	0.5353	0.5413	0.5477	0.5522	0.5570 (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			6.2900	0.9000	5.6610		(26)
Windows (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Half Glaze Door			2.1200	1.3000	2.7560		(26a)
Jet Floor Lo			46.4800	0.1400	6.5072	75.0000	3486.0000 (28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.2500	10.4825	60.0000	2515.8000 (29a)
E-WM-28	1.9700		1.9700	0.3000	0.5910	110.0000	216.7000 (29a)
Plane	46.4800		46.4800	0.1300	6.0424	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0401		(33)
E-WM-28			75.0800	0.0000	0.0000	110.0000	8258.8000 (32)
GF - Timber			51.9300			9.0000	467.3700 (32c)
GF - Masonry			22.8700			39.0000	891.9300 (32c)
1F - Timber			82.2700			9.0000	740.4300 (32c)
Internal Floor 1			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18668.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.8243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4082 (36)
Total fabric heat loss					(33) + (36) =		60.4483 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	41.5785	41.3875	41.2002	40.3207	40.1561	39.3901	39.3901	39.2482	39.6852	40.1561	40.4890	40.8371 (38)
Average = Sum(39)m / 12 =	102.0268	101.8358	101.6486	100.7690	100.6044	99.8384	99.8384	99.6965	100.1335	100.6044	100.9374	101.2854 (39)
	100.7682 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0975	1.0955	1.0935	1.0840	1.0822	1.0740	1.0740	1.0725	1.0772	1.0822	1.0858	1.0896 (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												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1533.6226 (45)
	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (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	21.8494	19.7149	21.7775	20.9933	21.6337	20.8673	21.5203	21.5938	20.9360	21.7180	21.0914	21.8273 (61)
Total heat required for water heating calculated for each month	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (64)
Heat gains from water heating, kWh/month	58.3311	51.1681	53.1593	46.8473	45.3237	39.6606	37.2973	42.0240	42.2969	48.6228	52.4217	56.6574 (65)
										Total per year (kWh/year) = Sum (64)m =		1789.1456 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4805	21.7433	17.6829	13.3871	10.0070	8.4483	9.1287	11.8658	15.9263	20.2221	23.6022	25.1609 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4192	246.9555	240.5641	226.9575	209.7817	193.6388	182.8544	180.3181	186.7095	200.3161	217.4919	233.6348 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205 (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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	78.4020	76.1430	71.4506	65.0657	60.9189	55.0842	50.1308	56.4838	58.7457	65.3532	72.8079	76.1524 (72)
Total internal gains	413.2633	410.8035	395.6592	371.3720	346.6692	323.1330	308.0755	314.6294	327.3432	351.8530	379.8636	400.9097 (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					4.5000	19.6403	0.6200		0.7000			26.5817 (76)
West					6.0600	19.6403	0.6200		0.7000			35.7967 (80)
Solar gains	62.3784	122.0254	200.9584	293.0859	359.1877	367.6926	350.0583	300.6949	233.7229	144.7934	77.7785	51.2970 (83)
Total gains	475.6417	532.8288	596.6176	664.4578	705.8569	690.8256	658.1338	615.3243	561.0661	496.6464	457.6422	452.2066 (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	50.8271	50.9225	51.0163	51.4616	51.5457	51.9412	51.9412	52.0152	51.7882	51.5457	51.3757	51.1992
alpha	4.3885	4.3948	4.4011	4.4308	4.4364	4.4627	4.4627	4.4677	4.4525	4.4364	4.4250	4.4133
util living area	0.9973	0.9952	0.9888	0.9679	0.9103	0.7837	0.6264	0.6815	0.8904	0.9804	0.9953	0.9979 (86)
MIT	19.5123	19.6571	19.9294	20.3008	20.6441	20.8813	20.9671	20.9522	20.7674	20.3209	19.8505	19.4844 (87)
Th 2	20.0028	20.0045	20.0062	20.0139	20.0154	20.0221	20.0221	20.0234	20.0195	20.0154	20.0124	20.0094 (88)
util rest of house	0.9966	0.9938	0.9854	0.9572	0.8780	0.7060	0.5054	0.5633	0.8383	0.9720	0.9937	0.9973 (89)
MIT 2	18.0036	18.2161	18.6138	19.1538	19.6299	19.9266	20.0060	19.9974	19.8016	19.1895	18.5047	17.9673 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	18.3206	18.5189	18.8902	19.3948	19.8430	20.1272	20.2079	20.1980	20.0045	19.4272	18.7874	18.2860 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1706	18.3689	18.7402	19.2448	19.6930	19.9772	20.0579	20.0480	19.8545	19.2772	18.6374	18.1360 (93)

8. Space heating requirement

Utilisation	0.9944	0.9904	0.9791	0.9460	0.8650	0.7019	0.5101	0.5666	0.8273	0.9630	0.9902	0.9955 (94)
Useful gains	472.9961	527.6890	584.1558	628.5922	610.5560	484.9226	335.7327	348.6467	464.1768	478.2537	453.1596	450.1798 (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	1415.1712	1371.6144	1244.1976	1042.4335	804.1278	536.8527	345.2327	363.6889	576.2212	872.9619	1164.5551	1411.5139 (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	700.9783	567.1179	491.0711	297.9657	144.0174	0.0000	0.0000	0.0000	0.0000	293.6629	512.2048	715.2326 (98)
Space heating												3722.2507 (98)
Space heating per m2												(98) / (4) = 40.0414 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.0000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4135.8341 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	700.9783	567.1179	491.0711	297.9657	144.0174	0.0000	0.0000	0.0000	0.0000	293.6629	512.2048	715.2326 (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)	778.8647	630.1310	545.6346	331.0730	160.0194	0.0000	0.0000	0.0000	0.0000	326.2921	569.1164	794.7029 (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	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (64)
Efficiency of water heater (217)m	89.3029	89.2569	89.1456	88.8869	88.3327	86.7000	86.7000	86.7000	86.7000	88.8485	89.1810	86.7000 (216)
Fuel for water heating, kWh/month	202.5167	177.8918	185.4057	164.3697	160.3931	143.5499	135.5386	151.9559	152.7145	170.6530	182.6538	196.8160 (219)
Water heating fuel used												2024.4588 (219)
Annual totals kWh/year												
Space heating fuel - main system												4135.8341 (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)												432.3329 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =												-588.2895
Total delivered energy for all uses												-588.2895 (233)
												6079.3362 (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	4135.8341	0.2160	893.3402 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2024.4588	0.2160	437.2831 (264)
Space and water heating			1330.6233 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	432.3329	0.5190	224.3808 (268)
Energy saving/generation technologies			
PV Unit	-588.2895	0.5190	-305.3223 (269)
Total CO2, kg/year			1288.6067 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.8600 (273)

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

DER		13.8600 ZC1
Total Floor Area	TFA	92.9600
Assumed number of occupants	N	2.6641
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.5806 ZC2
CO2 emissions from cooking, equation (L16)		1.9679 ZC3
Total CO2 emissions		31.4086 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		31.4086 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3850 (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) =	0.3273 (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	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3845 (22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			6.2900	1.0000	6.2900		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Jet Floor Lo			46.4800	0.1300	6.0424		(28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.1800	7.5474		(29a)
E-WM-28	1.9700		1.9700	0.1800	0.3546		(29a)
Plane	46.4800		46.4800	0.1300	6.0424		(30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.8208		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.4362 (36)
Total fabric heat loss						(33) + (36) =	56.2570 (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	43.0418	42.7939	42.5509	41.4098	41.1963	40.2024	40.2024	40.0184	40.5853	41.1963	41.6282	42.0798 (38)
Heat transfer coeff	99.2988	99.0509	98.8079	97.6668	97.4533	96.4594	96.4594	96.2754	96.8423	97.4533	97.8852	98.3368 (39)
Average = Sum(39)m / 12 =												97.6658 (39)
HLP	1.0682	1.0655	1.0629	1.0506	1.0483	1.0376	1.0376	1.0357	1.0418	1.0483	1.0530	1.0578 (40)
HLP (average)												1.0506 (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												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy conte	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Energy content (annual)												Total = Sum(45)m = 1533.6226 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (46)	
Water storage loss:												
Total storage loss												

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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 (56)
Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.6644	47.1073	46.6907	43.2618	44.7038	46.6907	47.1073	50.6644	49.3151	50.9589 (61)
Solar input	209.9628	185.0932	194.1678	172.2171	166.7365	146.8522	140.6956	156.8426	158.5748	180.5690	191.1161	204.9457 (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	209.9628	185.0932	194.1678	172.2171	166.7365	146.8522	140.6956	156.8426	158.5748	180.5690	191.1161	204.9457 (64)
	65.6085	57.7462	60.3810	53.3758	51.5879	45.2593	43.0932	48.2982	48.8398	55.8594	59.4776	63.9403 (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	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4805	21.7433	17.6829	13.3871	10.0070	8.4483	9.1287	11.8658	15.9263	20.2221	23.6022	25.1609	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4192	246.9555	240.5641	226.9575	209.7817	193.6388	182.8544	180.3181	186.7095	200.3161	217.4919	233.6348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	(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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	(71)
Water heating gains (Table 5)	88.1835	85.9319	81.1572	74.1331	69.3386	62.8601	57.9210	64.9169	67.8330	75.0798	82.6078	85.9413	(72)
Total internal gains	423.0448	420.5923	405.3658	380.4393	355.0889	330.9089	315.8657	323.0625	336.4304	361.5796	389.6635	410.6985	(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					4.5000	19.6403	0.6300	0.7000			0.7700	27.0104
West					6.0600	19.6403	0.6300	0.7000			0.7700	36.3741 (80)
Solar gains	63.3845	123.9935	204.1997	297.8131	364.9811	373.6231	355.7044	305.5448	237.4927	147.1288	79.0330	52.1243 (83)
Total gains	486.4293	544.5859	609.5655	678.2523	720.0700	704.5319	671.5701	628.6073	573.9231	508.7084	468.6965	462.8229 (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	65.0114	65.1741	65.3344	66.0977	66.2425	66.9251	66.9251	67.0530	66.6605	66.2425	65.9503	65.6474	
alpha	5.3341	5.3449	5.3556	5.4065	5.4162	5.4617	5.4617	5.4702	5.4440	5.4162	5.3967	5.3765	
util living area	0.9990	0.9979	0.9941	0.9782	0.9234	0.7845	0.6120	0.6703	0.9013	0.9879	0.9979	0.9992	(86)
MIT	19.7977	19.9213	20.1513	20.4667	20.7515	20.9333	20.9861	20.9778	20.8445	20.4741	20.0817	19.7777	(87)
Th 2	20.0269	20.0291	20.0312	20.0414	20.0432	20.0521	20.0521	20.0537	20.0487	20.0432	20.0394	20.0354	(88)
util rest of house	0.9986	0.9971	0.9918	0.9693	0.8906	0.7013	0.4904	0.5491	0.8464	0.9816	0.9970	0.9990	(89)
MIT 2	18.4108	18.5931	18.9300	19.3922	19.7842	20.0040	20.0465	20.0437	19.9123	19.4086	18.8355	18.3877	(90)
Living area fraction	18.7022	18.8721	19.1866	19.6180	19.9874	20.1993	20.2439	20.2400	20.1082	19.6325	19.0973	18.6797	(92)
Temperature adjustment	18.7022	18.8721	19.1866	19.6180	19.9874	20.1993	20.2439	20.2400	20.1082	19.6325	19.0973	18.6797	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9979	0.9958	0.9891	0.9641	0.8883	0.7155	0.5160	0.5744	0.8505	0.9777	0.9958	0.9984	(94)
Ext temp.	485.4090	542.3208	602.9084	653.8819	639.6075	504.1197	346.5362	361.0682	488.1500	497.3539	466.7099	462.0799	(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	1430.1174	1383.9539	1253.5366	1046.7912	807.6378	540.1016	351.4913	369.6932	581.8454	880.2424	1174.3569	1423.8871	(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 per m2	702.8630	565.5774	484.0673	282.8947	125.0145	0.0000	0.0000	0.0000	0.0000	284.8691	509.5059	715.5845	(98)
												3670.3766	(98)
												39.4834	(99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3929.7394 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	702.8630	565.5774	484.0673	282.8947	125.0145	0.0000	0.0000	0.0000	0.0000	284.8691	509.5059	715.5845	(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)	752.5300	605.5433	518.2734	302.8852	133.8485	0.0000	0.0000	0.0000	0.0000	304.9990	545.5095	766.1505	(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	209.9628	185.0932	194.1678	172.2171	166.7365	146.8522	140.6956	156.8426	158.5748	180.5690	191.1161	204.9457	(64)
Efficiency of water heater (217)m	87.8582	87.6807	87.2580	86.2929	84.3376	80.3000	80.3000	80.3000	80.3000	86.1940	87.4013	87.9375	(216)
Fuel for water heating, kWh/month	238.9791	211.0990	222.5215	199.5728	197.7013	182.8794	175.2124	195.3208	197.4779	209.4912	218.6651	233.0584	(219)
Water heating fuel used												2481.9790	(219)
Annual totals kWh/year													
Space heating fuel - main system												3929.7394	(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)												432.3329	(232)
Total delivered energy for all uses												6919.0512	(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	3929.7394	0.2160	848.8237 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2481.9790	0.2160	536.1075 (264)
Space and water heating			1384.9312 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	432.3329	0.5190	224.3808 (268)
Total CO2, kg/m2/year			1648.2369 (272)
Emissions per m2 for space and water heating			14.8981 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4137 (272b)
Emissions per m2 for pumps and fans			0.4187 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8981 * 1.00) + 2.4137 + 0.4187, rounded to 2 d.p.			17.7300 (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	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) =							0.1350 (8)
Pressure test										Yes							
Measured/design AP50																	4.0600
Infiltration rate																	0.3380 (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) =							0.2873 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.3663	0.3592	0.3520	0.3161	0.3089	0.2730	0.2730	0.2658	0.2873	0.3089	0.3232	0.3376	(22b)				
Effective ac	0.5671	0.5645	0.5619	0.5499	0.5477	0.5373	0.5373	0.5353	0.5413	0.5477	0.5522	0.5570	(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			6.2900	0.9000	5.6610		(26)
Windows (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Half Glaze Door			2.1200	1.3000	2.7560		(26a)
Jet Floor Lo			46.4800	0.1400	6.5072	75.0000	3486.0000 (28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.2500	10.4825	60.0000	2515.8000 (29a)
E-WM-28	1.9700		1.9700	0.3000	0.5910	110.0000	216.7000 (29a)
Plane	46.4800		46.4800	0.1300	6.0424	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0401		(33)
E-WM-28			75.0800	0.0000	0.0000	110.0000	8258.8000 (32)
GF - Timber			51.9300			9.0000	467.3700 (32c)
GF - Masonry			22.8700			39.0000	891.9300 (32c)
1F - Timber			82.2700			9.0000	740.4300 (32c)
Internal Floor 1			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			9.0000	418.3200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18250.3100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							196.3243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4082 (36)
Total fabric heat loss					(33) + (36) =		60.4483 (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	41.5785	41.3875	41.2002	40.3207	40.1561	39.3901	39.3901	39.2482	39.6852	40.1561	40.4890	40.8371 (38)
Heat transfer coeff	102.0268	101.8358	101.6486	100.7690	100.6044	99.8384	99.8384	99.6965	100.1335	100.6044	100.9374	101.2854 (39)
Average = Sum(39)m / 12 =												100.7682 (39)
HLP	1.0975	1.0955	1.0935	1.0840	1.0822	1.0740	1.0740	1.0725	1.0772	1.0822	1.0858	1.0896 (40)
HLP (average)												1.0840 (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 2.6641 (42)
Average daily hot water use (litres/day) 97.4725 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =	1533.6226	(45)
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
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	33.7883	29.5515	30.4945	26.5858	25.5097	22.0130	20.3982	23.4073	23.6868	27.6047	30.1327	32.7222 (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	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4805	21.7433	17.6829	13.3871	10.0070	8.4483	9.1287	11.8658	15.9263	20.2221	23.6022	25.1609	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4192	246.9555	240.5641	226.9575	209.7817	193.6388	182.8544	180.3181	186.7095	200.3161	217.4919	233.6348	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	(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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	(71)
Water heating gains (Table 5)	45.4144	43.9754	40.9872	36.9248	34.2873	30.5736	27.4170	31.4614	32.8984	37.1031	41.8510	43.9814	(72)
Total internal gains	377.2757	375.6359	362.1958	340.2310	317.0376	295.6223	282.3617	286.6070	298.4958	320.6029	345.9067	365.7387	(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					4.5000	19.6403	0.6200	0.7000			0.7700	26.5817
West					6.0600	19.6403	0.6200	0.7000			0.7700	35.7967
Solar gains	62.3784	122.0254	200.9584	293.0859	359.1877	367.6926	350.0583	300.6949	233.7229	144.7934	77.7785	51.2970
Total gains	439.6541	497.6612	563.1542	633.3168	676.2253	663.3149	632.4200	587.3019	532.2188	465.3963	423.6852	417.0356

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	49.6882	49.7814	49.8731	50.3084	50.3907	50.7774	50.7774	50.8496	50.6277	50.3907	50.2245	50.0519	
alpha	4.3125	4.3188	4.3249	4.3539	4.3594	4.3852	4.3852	4.3900	4.3752	4.3594	4.3483	4.3368	
util living area	0.9978	0.9960	0.9903	0.9714	0.9183	0.7988	0.6447	0.7024	0.9028	0.9835	0.9962	0.9983	(86)
MIT	19.4426	19.5912	19.8711	20.2541	20.6114	20.8650	20.9609	20.9430	20.7398	20.2730	19.7893	19.4151	(87)
Th 2	20.0028	20.0045	20.0062	20.0139	20.0154	20.0221	20.0221	20.0234	20.0195	20.0154	20.0124	20.0094	(88)
util rest of house	0.9973	0.9948	0.9874	0.9619	0.8886	0.7236	0.5229	0.5848	0.8550	0.9765	0.9949	0.9978	(89)
MIT 2	18.5704	18.7199	18.9998	19.3833	19.7242	19.9462	20.0086	20.0014	19.8492	19.4067	18.9241	18.5479	(90)
Living area fraction	18.7536	18.9030	19.1828	19.5662	19.9106	20.1392	20.2087	20.1992	20.0363	19.5887	19.1059	18.7301	(91)
Temperature adjustment	18.7536	18.9030	19.1828	19.5662	19.9106	20.1392	20.2087	20.1992	20.0363	19.5887	19.1059	18.7301	(92)
adjusted MIT	18.7536	18.9030	19.1828	19.5662	19.9106	20.1392	20.2087	20.1992	20.0363	19.5887	19.1059	18.7301	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9962	0.9931	0.9841	0.9564	0.8848	0.7337	0.5478	0.6081	0.8560	0.9724	0.9932	0.9970	(94)
Ext temp.	437.9812	494.2126	554.2219	605.6842	598.3023	486.6857	346.4668	357.1242	455.5658	452.5505	420.8197	415.7739	(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	1474.6595	1426.0025	1289.1912	1074.8264	826.0261	553.0245	360.2822	378.7683	594.4249	904.3059	1211.8399	1471.6859	(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	771.2887	626.1628	546.8172	337.7824	169.4265	0.0000	0.0000	0.0000	0.0000	336.1060	569.5346	785.5985	(98)
Space heating per m2												4142.7167	(98)
												44.5645	(99)

8c. Space cooling requirement

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	938.4809	738.8041	757.6937	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7859	0.8622	0.8304	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	737.5670	637.0035	629.1884	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	877.4090	839.2458	788.6500	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	100.6862	150.4682	118.6395	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			369.7939 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	25.1716	37.6171	29.6599	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												92.4485 (107)
Energy for space heating												0.9945 (108)
Energy for space cooling												44.5645 (99)
Total												0.9945 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.5590 (109)
												45.6 (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	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3850 (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) =	0.3273 (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	0.4173	0.4091	0.4009	0.3600	0.3518	0.3109	0.3109	0.3027	0.3273	0.3518	0.3682	0.3845 (22b)
Effective ac	0.5871	0.5837	0.5804	0.5648	0.5619	0.5483	0.5483	0.5458	0.5536	0.5619	0.5678	0.5739 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			6.2900	1.0000	6.2900		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Jet Floor Lo			46.4800	0.1300	6.0424		(28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.1800	7.5474		(29a)
E-WM-28	1.9700		1.9700	0.1800	0.3546		(29a)
Plane	46.4800		46.4800	0.1300	6.0424		(30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.8208		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.4362 (36)
Total fabric heat loss						(33) + (36) =	56.2570 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	43.0418	42.7939	42.5509	41.4098	41.1963	40.2024	40.2024	40.0184	40.5853	41.1963	41.6282	42.0798 (38)
Heat transfer coeff	99.2988	99.0509	98.8079	97.6668	97.4533	96.4594	96.4594	96.2754	96.8423	97.4533	97.8852	98.3368 (39)
Average = Sum(39)m / 12 =												97.6658 (39)
HLP	1.0682	1.0655	1.0629	1.0506	1.0483	1.0376	1.0376	1.0357	1.0418	1.0483	1.0530	1.0578 (40)
HLP (average)												1.0506 (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												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Daily hot water use	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy conte	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Energy content (annual)												Total = Sum(45)m = 1533.6226 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (56)
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)
	33.7883	29.5515	30.4945	26.5858	25.5097	22.0130	20.3982	23.4073	23.6868	27.6047	30.1327	32.7222 (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	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053	133.2053 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.4805	21.7433	17.6829	13.3871	10.0070	8.4483	9.1287	11.8658	15.9263	20.2221	23.6022	25.1609 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	244.4192	246.9555	240.5641	226.9575	209.7817	193.6388	182.8544	180.3181	186.7095	200.3161	217.4919	233.6348 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205	36.3205 (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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	45.4144	43.9754	40.9872	36.9248	34.2873	30.5736	27.4170	31.4614	32.8984	37.1031	41.8510	43.9814 (72)
Total internal gains	377.2757	375.6359	362.1958	340.2310	317.0376	295.6223	282.3617	286.6070	298.4958	320.6029	345.9067	365.7387 (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				4.5000	19.6403	0.6300		0.7000		0.7700		27.0104 (76)	
West				6.0600	19.6403	0.6300		0.7000		0.7700		36.3741 (80)	

Solar gains	63.3845	123.9935	204.1997	297.8131	364.9811	373.6231	355.7044	305.5448	237.4927	147.1288	79.0330	52.1243	(83)
Total gains	440.6602	499.6294	566.3955	638.0440	682.0187	669.2454	638.0661	592.1518	535.9885	467.7317	424.9397	417.8630	(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	65.0114	65.1741	65.3344	66.0977	66.2425	66.9251	66.9251	67.0530	66.6605	66.2425	65.9503	65.6474
alpha	5.3341	5.3449	5.3556	5.4065	5.4162	5.4617	5.4617	5.4702	5.4440	5.4162	5.3967	5.3765
util living area	0.9994	0.9986	0.9958	0.9832	0.9367	0.8092	0.6393	0.7025	0.9215	0.9918	0.9987	0.9995 (86)
MIT	19.7510	19.8756	20.1082	20.4296	20.7247	20.9218	20.9830	20.9723	20.8203	20.4342	20.0371	19.7316 (87)
Th 2	20.0269	20.0291	20.0312	20.0414	20.0432	20.0521	20.0521	20.0537	20.0487	20.0432	20.0394	20.0354 (88)
util rest of house	0.9992	0.9981	0.9942	0.9761	0.9080	0.7287	0.5146	0.5796	0.8736	0.9873	0.9982	0.9994 (89)
MIT 2	18.8769	19.0032	19.2368	19.5626	19.8438	20.0126	20.0473	20.0449	19.9375	19.5713	19.1730	18.8644 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	19.0605	19.1865	19.4199	19.7447	20.0288	20.2036	20.2439	20.2397	20.1230	19.7526	19.3546	19.0466 (92)
Temperature adjustment												0.0000
adjusted MIT	19.0605	19.1865	19.4199	19.7447	20.0288	20.2036	20.2439	20.2397	20.1230	19.7526	19.3546	19.0466 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9988	0.9975	0.9928	0.9733	0.9075	0.7430	0.5411	0.6056	0.8782	0.9854	0.9976	0.9991 (94)
Useful gains	440.1533	498.3893	562.3144	621.0041	618.9165	497.2714	345.2737	358.5916	470.7042	460.8797	423.9241	417.5052 (95)
Ext temp.	4.3000	4.3000	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	1465.6989	1415.0867	1276.5851	1059.1699	811.6727	540.5236	351.4862	369.6699	583.2810	891.9496	1199.5411	1459.9691 (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	763.0059	616.0207	531.4174	315.4794	143.4106	0.0000	0.0000	0.0000	0.0000	320.7160	558.4443	775.5932 (98)
Space heating												4024.0875 (98)
Space heating per m2										(98) / (4) =		43.2884 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8345	0.9072	0.8779	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	756.6449	647.5937	642.3858	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	884.3408	845.8451	794.3187	0.0000	0.0000	0.0000	0.0000 (102)
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	91.9410	147.4991	113.0381	0.0000	0.0000	0.0000	0.0000 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												352.4782 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	22.9853	36.8748	28.2595	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												88.1196 (107)
Space cooling per m2												0.9479 (108)
Energy for space heating												43.2884 (99)
Energy for space cooling												0.9479 (108)
Total												44.2363 (109)
Target Fabric Energy Efficiency (TFEE)												50.9 (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	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3380 (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) =	0.2873 (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	0.3017	0.2801	0.2873	0.2730	0.2730	0.2658	0.2586	0.2514	0.2442	0.2658	0.2514	0.2658 (22b)
Effective ac	0.5455	0.5392	0.5413	0.5373	0.5373	0.5353	0.5334	0.5316	0.5298	0.5353	0.5316	0.5353 (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			6.2900	0.9000	5.6610		(26)
Windows (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Half Glaze Door			2.1200	1.3000	2.7560		(26a)
Jet Floor Lo			46.4800	0.1400	6.5072	75.0000	3486.0000 (28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.2500	10.4825	60.0000	2515.8000 (29a)
E-WM-28	1.9700		1.9700	0.3000	0.5910	110.0000	216.7000 (29a)
Plane	46.4800		46.4800	0.1300	6.0424	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0401		(33)
E-WM-28			75.0800	0.0000	0.0000	110.0000	8258.8000 (32)
GF - Timber			51.9300			9.0000	467.3700 (32c)
GF - Masonry			22.8700			39.0000	891.9300 (32c)
1F - Timber			82.2700			9.0000	740.4300 (32c)
Internal Floor 1			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18668.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.8243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4082 (36)
Total fabric heat loss					(33) + (36) =		60.4483 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.9954	39.5357	39.6852	39.3901	39.3901	39.2482	39.1101	38.9759	38.8453	39.2482	38.9759	39.2482 (38)
Average = Sum(39)m / 12 =	100.4437	99.9840	100.1335	99.8384	99.8384	99.6965	99.5585	99.4242	99.2936	99.6965	99.4242	99.6965 (39)
	99.7523 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0805	1.0756	1.0772	1.0740	1.0740	1.0725	1.0710	1.0695	1.0681	1.0725	1.0695	1.0725 (40)
Days in month												
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1533.6226 (45)
	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (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	21.8494	19.7149	21.7775	20.9933	21.6337	20.8673	21.5203	21.5938	20.9360	21.7180	21.0914	21.8273 (61)
Total heat required for water heating calculated for each month	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	58.3311	51.1681	53.1593	46.8473	45.3237	39.6606	37.2973	42.0240	42.2969	48.6228	52.4217	56.6574 (65)
												1789 (64)
												1789 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.2012	54.3584	44.2072	33.4677	25.0175	21.1208	22.8218	29.6646	39.8158	50.5553	59.0055	62.9022 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487 (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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	78.4020	76.1430	71.4506	65.0657	60.9189	55.0842	50.1308	56.4838	58.7457	65.3532	72.8079	76.1524 (72)
Total internal gains	614.3389	609.0225	584.6396	547.2069	508.9743	475.1491	455.8005	465.2109	487.1634	524.8186	566.3591	597.6941 (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			4.5000	25.1925		0.6200		0.7000		0.7700		34.0963 (76)
West			6.0600	25.1925		0.6200		0.7000		0.7700		45.9164 (80)

Solar gains	80.0127	133.1407	220.4350	322.0865	373.9862	415.3731	392.5456	346.3458	270.3293	170.3165	99.4386	64.6770 (83)
Total gains	694.3516	742.1633	805.0746	869.2934	882.9605	890.5223	848.3461	811.5566	757.4927	695.1351	665.7977	662.3711 (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	51.6282	51.8656	51.7882	51.9412	51.9412	52.0152	52.0873	52.1576	52.2262	52.0152	52.1576	52.0152
alpha	4.4419	4.4577	4.4525	4.4627	4.4627	4.4677	4.4725	4.4772	4.4817	4.4677	4.4772	4.4677
util living area	0.9865	0.9810	0.9621	0.9102	0.8004	0.6042	0.4501	0.4685	0.7319	0.9206	0.9751	0.9884 (86)
MIT	19.8679	19.9766	20.2376	20.5659	20.8274	20.9632	20.9921	20.9908	20.9134	20.6141	20.2048	19.8558 (87)
Th 2	20.0168	20.0208	20.0195	20.0221	20.0221	20.0234	20.0246	20.0258	20.0269	20.0234	20.0258	20.0234 (88)
util rest of house	0.9830	0.9760	0.9518	0.8850	0.7454	0.5139	0.3413	0.3561	0.6493	0.8922	0.9674	0.9853 (89)
MIT 2	18.5299	18.6897	19.0628	19.5213	19.8567	19.9997	20.0217	20.0224	19.9608	19.5965	19.0245	18.5173 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	18.8110	18.9601	19.3096	19.7407	20.0607	20.2021	20.2256	20.2259	20.1609	19.8103	19.2725	18.7985 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6610	18.8101	19.1596	19.5907	19.9107	20.0521	20.0756	20.0759	20.0109	19.6603	19.1225	18.6485 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9761	0.9675	0.9400	0.8717	0.7383	0.5167	0.3471	0.3620	0.6478	0.8790	0.9575	0.9790 (94)
Ext temp.	677.7258	718.0800	756.7807	757.7267	651.9221	460.1151	294.4973	293.8121	490.6995	611.0097	637.5178	648.4690 (95)
Heat loss rate W	4.9000	5.3000	7.0000	9.5000	12.5000	15.3000	17.1000	17.1000	14.7000	11.4000	7.9000	5.0000 (96)
Month fracti	1382.2069	1350.7938	1217.5876	1007.4442	739.8682	473.7709	296.2468	295.8725	527.3402	823.5258	1115.7852	1360.7092 (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	524.1339	425.1836	342.8404	179.7966	65.4319	0.0000	0.0000	0.0000	0.0000	158.1120	344.3525	529.9067 (98)
RHI space heating demand												2570 (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	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) = 0.1350 (8)				
Pressure test										Yes				
Measured/design AP50										4.0600				
Infiltration rate										0.3380 (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) = 0.2873 (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	0.3663	0.3592	0.3520	0.3161	0.3089	0.2730	0.2730	0.2658	0.2873	0.3089	0.3232	0.3376 (22b)		
Effective ac	0.5671	0.5645	0.5619	0.5499	0.5477	0.5373	0.5373	0.5353	0.5413	0.5477	0.5522	0.5570 (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			6.2900	0.9000	5.6610		(26)
Windows (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Half Glaze Door			2.1200	1.3000	2.7560		(26a)
Jet Floor Lo			46.4800	0.1400	6.5072	75.0000	3486.0000 (28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.2500	10.4825	60.0000	2515.8000 (29a)
E-WM-28	1.9700		1.9700	0.3000	0.5910	110.0000	216.7000 (29a)
Plane	46.4800		46.4800	0.1300	6.0424	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0401		(33)
E-WM-28			75.0800	0.0000	0.0000	110.0000	8258.8000 (32)
GF - Timber			51.9300			9.0000	467.3700 (32c)
GF - Masonry			22.8700			39.0000	891.9300 (32c)
1F - Timber			82.2700			9.0000	740.4300 (32c)
Internal Floor 1			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18668.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.8243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4082 (36)
Total fabric heat loss					(33) + (36) =		60.4483 (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	41.5785	41.3875	41.2002	40.3207	40.1561	39.3901	39.3901	39.2482	39.6852	40.1561	40.4890	40.8371 (38)
Heat transfer coeff	102.0268	101.8358	101.6486	100.7690	100.6044	99.8384	99.8384	99.6965	100.1335	100.6044	100.9374	101.2854 (39)
Average = Sum(39)m / 12 =												100.7682 (39)
HLP	1.0975	1.0955	1.0935	1.0840	1.0822	1.0740	1.0740	1.0725	1.0772	1.0822	1.0858	1.0896 (40)
HLP (average)												1.0840 (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	2.6641 (42)
Average daily hot water use (litres/day)	97.4725 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1533.6226 (45)
	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (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	21.8494	19.7149	21.7775	20.9933	21.6337	20.8673	21.5203	21.5938	20.9360	21.7180	21.0914	21.8273 (61)
Total heat required for water heating calculated for each month	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (64)
Heat gains from water heating, kWh/month	58.3311	51.1681	53.1593	46.8473	45.3237	39.6606	37.2973	42.0240	42.2969	48.6228	52.4217	56.6574 (65)
										Total per year (kWh/year) = Sum (64)m =		1789.1456 (64)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464 (66)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	61.2012	54.3584	44.2072	33.4677	25.0175	21.1208	22.8218	29.6646	39.8158	50.5553	59.0055	62.9022 (67)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086 (68)
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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	78.4020	76.1430	71.4506	65.0657	60.9189	55.0842	50.1308	56.4838	58.7457	65.3532	72.8079	76.1524 (72)
Total internal gains	614.3389	609.0225	584.6396	547.2069	508.9743	475.1491	455.8005	465.2109	487.1634	524.8186	566.3591	597.6941 (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				4.5000	19.6403	0.6200	0.7000		26.5817 (76)			
West				6.0600	19.6403	0.6200	0.7000	0.7700	35.7967 (80)			
Solar gains	62.3784	122.0254	200.9584	293.0859	359.1877	367.6926	350.0583	300.6949	233.7229	144.7934	77.7785	51.2970 (83)
Total gains	676.7173	731.0479	785.5980	840.2928	868.1620	842.8417	805.8588	765.9058	720.8863	669.6120	644.1376	648.9911 (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	50.8271	50.9225	51.0163	51.4616	51.5457	51.9412	51.9412	52.0152	51.7882	51.5457	51.3757	51.1992
alpha	4.3885	4.3948	4.4011	4.4308	4.4364	4.4627	4.4627	4.4677	4.4525	4.4364	4.4250	4.4133
util living area	0.9894	0.9839	0.9697	0.9312	0.8452	0.6898	0.5280	0.5729	0.7989	0.9455	0.9825	0.9912 (86)
MIT	19.7485	19.8859	20.1376	20.4698	20.7550	20.9299	20.9832	20.9759	20.8602	20.4984	20.0657	19.7172 (87)
Th 2	20.0028	20.0045	20.0062	20.0139	20.0154	20.0221	20.0221	20.0234	20.0195	20.0154	20.0124	20.0094 (88)
util rest of house	0.9867	0.9797	0.9614	0.9115	0.8006	0.6073	0.4186	0.4628	0.7290	0.9258	0.9771	0.9889 (89)
MIT 2	18.3469	18.5471	18.9107	19.3846	19.7638	19.9696	20.0144	20.0113	19.8999	19.4334	18.8150	18.3060 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	18.6414	18.8284	19.1685	19.6126	19.9720	20.1714	20.2180	20.2140	20.1017	19.6572	19.0778	18.6024 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4914	18.6784	19.0185	19.4626	19.8220	20.0214	20.0680	20.0640	19.9517	19.5072	18.9278	18.4524 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9808	0.9719	0.9505	0.8978	0.7905	0.6072	0.4239	0.4676	0.7235	0.9127	0.9689	0.9836 (94)
Ext temp.	663.7023	710.4916	746.7375	754.4502	686.2845	511.8055	341.6387	358.1697	521.5618	611.1478	624.0968	638.3637 (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	1447.9011	1403.1332	1272.4845	1064.3856	817.1093	541.2617	346.2361	365.2867	585.9468	896.0990	1193.8631	1443.5647 (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	583.4439	465.4552	391.1557	223.1535	97.3336	0.0000	0.0000	0.0000	0.0000	212.0037	410.2317	599.0696 (98)
Space heating per m2												2981.8469 (98)
										(98) / (4) =		32.0767 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.0000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3313.1632 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	583.4439	465.4552	391.1557	223.1535	97.3336	0.0000	0.0000	0.0000	0.0000	212.0037	410.2317	599.0696	(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)	648.2710	517.1724	434.6175	247.9484	108.1484	0.0000	0.0000	0.0000	0.0000	235.5597	455.8130	665.6329	(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	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140	(64)
Efficiency of water heater (217)m	89.1966	89.1370	88.9939	88.6647	88.0142	86.7000	86.7000	86.7000	86.7000	88.5939	89.0368	86.7000	(216)
Fuel for water heating, kWh/month	202.7579	178.1310	185.7218	164.7816	160.9735	143.5499	135.5386	151.9559	152.7145	171.1434	182.9496	89.2294	(217)
Water heating fuel used												197.0360	(219)
Annual totals kWh/year												2027.2536	(219)
Space heating fuel - main system													3313.1632 (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)													432.3329 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =											-588.2895	-588.2895	(233)
Total delivered energy for all uses												5259.4601	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3313.1632	3.4800	115.2981 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2027.2536	3.4800	70.5484 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	432.3329	13.1900	57.0247 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-588.2895	13.1900	-77.5954 (252)
Total energy cost			295.1683 (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] =	0.8986 (257)
SAP value	87.4645	
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	3313.1632	0.2160	715.6433	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2027.2536	0.2160	437.8868	(264)
Space and water heating			1153.5300	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	432.3329	0.5190	224.3808	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			1111.5135	(272)
CO2 emissions per m2			11.9600	(273)
EI value			89.2039	
EI rating			89	(274)
EI band			B	

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Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW	
Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8814 = 3.948$, stars = 4
Water heating environmental impact	$0.216 / 0.8814 = 0.2451$, 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	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3380 (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) =	0.2873 (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	0.3017	0.2801	0.2873	0.2730	0.2730	0.2658	0.2586	0.2514	0.2442	0.2658	0.2514	0.2658 (22b)
Effective ac	0.5455	0.5392	0.5413	0.5373	0.5373	0.5353	0.5334	0.5316	0.5298	0.5353	0.5316	0.5353 (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			6.2900	0.9000	5.6610		(26)
Windows (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Half Glaze Door			2.1200	1.3000	2.7560		(26a)
Jet Floor Lo			46.4800	0.1400	6.5072	75.0000	3486.0000 (28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.2500	10.4825	60.0000	2515.8000 (29a)
E-WM-28	1.9700		1.9700	0.3000	0.5910	110.0000	216.7000 (29a)
Plane	46.4800		46.4800	0.1300	6.0424	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0401		(33)
E-WM-28			75.0800	0.0000	0.0000	110.0000	8258.8000 (32)
GF - Timber			51.9300			9.0000	467.3700 (32c)
GF - Masonry			22.8700			39.0000	891.9300 (32c)
1F - Timber			82.2700			9.0000	740.4300 (32c)
Internal Floor 1			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18668.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.8243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4082 (36)
Total fabric heat loss					(33) + (36) =		60.4483 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	39.9954	39.5357	39.6852	39.3901	39.3901	39.2482	39.1101	38.9759	38.8453	39.2482	38.9759	39.2482 (38)
Average = Sum(39)m / 12 =	100.4437	99.9840	100.1335	99.8384	99.8384	99.6965	99.5585	99.4242	99.2936	99.6965	99.4242	99.6965 (39)
	99.7523 (39)											
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0805	1.0756	1.0772	1.0740	1.0740	1.0725	1.0710	1.0695	1.0681	1.0725	1.0695	1.0725 (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												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use												

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Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1533.6226 (45)
	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (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	21.8494	19.7149	21.7775	20.9933	21.6337	20.8673	21.5203	21.5938	20.9360	21.7180	21.0914	21.8273 (61)
Total heat required for water heating calculated for each month	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (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	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (64)
								Total per year (kWh/year) =	Sum (64)m =			1789.1456 (64)
Heat gains from water heating, kWh/month	58.3311	51.1681	53.1593	46.8473	45.3237	39.6606	37.2973	42.0240	42.2969	48.6228	52.4217	56.6574 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.2012	54.3584	44.2072	33.4677	25.0175	21.1208	22.8218	29.6646	39.8158	50.5553	59.0055	62.9022 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487 (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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	78.4020	76.1430	71.4506	65.0657	60.9189	55.0842	50.1308	56.4838	58.7457	65.3532	72.8079	76.1524 (72)
Total internal gains	614.3389	609.0225	584.6396	547.2069	508.9743	475.1491	455.8005	465.2109	487.1634	524.8186	566.3591	597.6941 (73)

6. Solar gains

[Jan]			Area	Solar flux		g		FF		Access		Gains
			m2	Table 6a		Specific data		Specific data		factor		W
				W/m2		or Table 6b		or Table 6c		Table 6d		
East			4.5000		25.1925		0.6200		0.7000		0.7700	34.0963 (76)
West			6.0600		25.1925		0.6200		0.7000		0.7700	45.9164 (80)

Solar gains	80.0127	133.1407	220.4350	322.0865	373.9862	415.3731	392.5456	346.3458	270.3293	170.3165	99.4386	64.6770 (83)
Total gains	694.3516	742.1633	805.0746	869.2934	882.9605	890.5223	848.3461	811.5566	757.4927	695.1351	665.7977	662.3711 (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	51.6282	51.8656	51.7882	51.9412	51.9412	52.0152	52.0873	52.1576	52.2262	52.0152	52.1576	52.0152
alpha	4.4419	4.4577	4.4525	4.4627	4.4627	4.4677	4.4725	4.4772	4.4817	4.4677	4.4772	4.4677
util living area	0.9865	0.9810	0.9621	0.9102	0.8004	0.6042	0.4501	0.4685	0.7319	0.9206	0.9751	0.9884 (86)
MIT	19.8679	19.9766	20.2376	20.5659	20.8274	20.9632	20.9921	20.9908	20.9134	20.6141	20.2048	19.8558 (87)
Th 2	20.0168	20.0208	20.0195	20.0221	20.0221	20.0234	20.0246	20.0258	20.0269	20.0234	20.0258	20.0234 (88)
util rest of house	0.9830	0.9760	0.9518	0.8850	0.7454	0.5139	0.3413	0.3561	0.6493	0.8922	0.9674	0.9853 (89)
MIT 2	18.5299	18.6897	19.0628	19.5213	19.8567	19.9997	20.0217	20.0224	19.9608	19.5965	19.0245	18.5173 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	18.8110	18.9601	19.3096	19.7407	20.0607	20.2021	20.2256	20.2259	20.1609	19.8103	19.2725	18.7985 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6610	18.8101	19.1596	19.5907	19.9107	20.0521	20.0756	20.0759	20.0109	19.6603	19.1225	18.6485 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9761	0.9675	0.9400	0.8717	0.7383	0.5167	0.3471	0.3620	0.6478	0.8790	0.9575	0.9790 (94)
Useful gains	677.7258	718.0800	756.7807	757.7267	651.9221	460.1151	294.4973	293.8121	490.6995	611.0097	637.5178	648.4690 (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	1382.2069	1350.7938	1217.5876	1007.4442	739.8682	473.7709	296.2468	295.8725	527.3402	823.5258	1115.7852	1360.7092 (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	524.1339	425.1836	342.8404	179.7966	65.4319	0.0000	0.0000	0.0000	0.0000	158.1120	344.3525	529.9067 (98)
Space heating												2569.7577 (98)
Space heating per m2										(98) / (4) =		27.6437 (99)

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8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.0000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2855.2863	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	524.1339	425.1836	342.8404	179.7966	65.4319	0.0000	0.0000	0.0000	0.0000	158.1120	344.3525	529.9067	(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)	582.3710	472.4263	380.9338	199.7740	72.7021	0.0000	0.0000	0.0000	0.0000	175.6800	382.6139	588.7853	(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	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140	(64)
Efficiency of water heater (217)m	89.1297	89.0781	88.8994	88.4900	87.7161	86.7000	86.7000	86.7000	86.7000	88.3538	88.9132	86.7000	(216)
Fuel for water heating, kWh/month	202.9101	178.2488	185.9192	165.1068	161.5205	143.5499	135.5386	151.9559	152.7145	171.6086	183.2039	197.2013	(219)
Water heating fuel used												2029.4782	(219)
Annual totals kWh/year													
Space heating fuel - main system												2855.2863	(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)												432.3329	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												4723.9981	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2855.2863	3.9300	112.2128 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2029.4782	3.9300	79.7585 (247)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	432.3329	17.5600	75.9176 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-668.0993	17.5600	-117.3182 (252)
Total energy cost			251.7407 (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	2855.2863	0.2160	616.7418 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2029.4782	0.2160	438.3673 (264)
Space and water heating			1055.1091 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	432.3329	0.5190	224.3808 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			971.6713 (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	2855.2863	1.2200	3483.4493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2029.4782	1.2200	2475.9634 (264)
Space and water heating			5959.4127 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	432.3329	3.0700	1327.2619 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			5465.8597 (272)
Primary energy kWh/m2/year			58.7980 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 87
Current environmental impact rating: B 89

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 32	-195 kg (20.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£32 2.10 kg/m²	B 89	B 91
Total Savings	£32 2.10 kg/m²		

Potential energy efficiency rating: B 89
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 445 TEST (30 Jul 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	£89	£98	-£9
Mains gas	£280	£240	£40
Space heating	£213	£213	£0
Water heating	£80	£48	£32
Lighting	£76	£76	£0
Generated (PV)	-£117	-£117	£0
Total cost of fuels	£252	£221	£31
Total cost of uses	£252	£220	£32
Delivered energy	51 kWh/m²	40 kWh/m²	10 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	47 kWh/m²	12 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	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) =							0.1350 (8)
Pressure test										Yes							
Measured/design AP50																	4.0600
Infiltration rate																	0.3380 (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) =							0.2873 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)				
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)				
	0.3663	0.3592	0.3520	0.3161	0.3089	0.2730	0.2730	0.2658	0.2873	0.3089	0.3232	0.3376	(22b)				
Effective ac	0.5671	0.5645	0.5619	0.5499	0.5477	0.5373	0.5373	0.5353	0.5413	0.5477	0.5522	0.5570	(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			6.2900	0.9000	5.6610		(26)
Windows (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Half Glaze Door			2.1200	1.3000	2.7560		(26a)
Jet Floor Lo			46.4800	0.1400	6.5072	75.0000	3486.0000 (28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.2500	10.4825	60.0000	2515.8000 (29a)
E-WM-28	1.9700		1.9700	0.3000	0.5910	110.0000	216.7000 (29a)
Plane	46.4800		46.4800	0.1300	6.0424	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0401		(33)
E-WM-28			75.0800	0.0000	0.0000	110.0000	8258.8000 (32)
GF - Timber			51.9300			9.0000	467.3700 (32c)
GF - Masonry			22.8700			39.0000	891.9300 (32c)
1F - Timber			82.2700			9.0000	740.4300 (32c)
Internal Floor 1			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18668.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.8243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4082 (36)
Total fabric heat loss					(33) + (36) =		60.4483 (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	41.5785	41.3875	41.2002	40.3207	40.1561	39.3901	39.3901	39.2482	39.6852	40.1561	40.4890	40.8371 (38)
Heat transfer coeff	102.0268	101.8358	101.6486	100.7690	100.6044	99.8384	99.8384	99.6965	100.1335	100.6044	100.9374	101.2854 (39)
Average = Sum(39)m / 12 =												100.7682 (39)
HLP	1.0975	1.0955	1.0935	1.0840	1.0822	1.0740	1.0740	1.0725	1.0772	1.0822	1.0858	1.0896 (40)
HLP (average)												1.0840 (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												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1533.6226 (45)
	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (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	21.8494	19.7149	21.7775	20.9933	21.6337	20.8673	21.5203	21.5938	20.9360	21.7180	21.0914	21.8273 (61)
Total heat required for water heating calculated for each month	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (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												1.1826 (H8)
Utilisation factor												0.5707 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4725 (H14)
Volume ratio Veff/V												0.7694 (H15)
Solar storage volume factor												0.9476 (H16)
Solar input												-862.3999 (H17)
Solar input	-25.0079	-41.7310	-71.0726	-95.2513	-117.6749	-115.6932	-114.1643	-99.7459	-78.1210	-53.3475	-29.6629	-20.9273 (63)
								Solar input (sum of months) =	Sum (63)m =			-862.3999 (63)
Output from w/h	155.8453	117.0497	94.2084	50.8518	24.0046	8.7645	3.3477	31.9998	54.2824	98.2752	133.2295	154.8867 (64)
								Total per year (kWh/year) =	Sum (64)m =			926.7457 (64)
Heat gains from water heating, kWh/month	58.3311	51.1681	53.1593	46.8473	45.3237	39.6606	37.2973	42.0240	42.2969	48.6228	52.4217	56.6574 (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	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.2012	54.3584	44.2072	33.4677	25.0175	21.1208	22.8218	29.6646	39.8158	50.5553	59.0055	62.9022 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487 (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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	78.4020	76.1430	71.4506	65.0657	60.9189	55.0842	50.1308	56.4838	58.7457	65.3532	72.8079	76.1524 (72)
Total internal gains	614.3389	609.0225	584.6396	547.2069	508.9743	475.1491	455.8005	465.2109	487.1634	524.8186	566.3591	597.6941 (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					4.5000	19.6403	0.6200		0.7000			26.5817 (76)
West					6.0600	19.6403	0.6200		0.7000			35.7967 (80)

Solar gains	62.3784	122.0254	200.9584	293.0859	359.1877	367.6926	350.0583	300.6949	233.7229	144.7934	77.7785	51.2970 (83)
Total gains	676.7173	731.0479	785.5980	840.2928	868.1620	842.8417	805.8588	765.9058	720.8863	669.6120	644.1376	648.9911 (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	50.8271	50.9225	51.0163	51.4616	51.5457	51.9412	51.9412	52.0152	51.7882	51.5457	51.3757	51.1992
alpha	4.3885	4.3948	4.4011	4.4308	4.4364	4.4627	4.4627	4.4677	4.4525	4.4364	4.4250	4.4133
util living area	0.9894	0.9839	0.9697	0.9312	0.8452	0.6898	0.5280	0.5729	0.7989	0.9455	0.9825	0.9912 (86)
MIT	19.7485	19.8859	20.1376	20.4698	20.7550	20.9299	20.9832	20.9759	20.8602	20.4984	20.0657	19.7172 (87)
Th 2	20.0028	20.0045	20.0062	20.0139	20.0154	20.0221	20.0221	20.0234	20.0195	20.0154	20.0124	20.0094 (88)
util rest of house	0.9867	0.9797	0.9614	0.9115	0.8006	0.6073	0.4186	0.4628	0.7290	0.9258	0.9771	0.9889 (89)
MIT 2	18.3469	18.5471	18.9107	19.3846	19.7638	19.9696	20.0144	20.0113	19.8999	19.4334	18.8150	18.3060 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	18.6414	18.8284	19.1685	19.6126	19.9720	20.1714	20.2180	20.2140	20.1017	19.6572	19.0778	18.6024 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4914	18.6784	19.0185	19.4626	19.8220	20.0214	20.0680	20.0640	19.9517	19.5072	18.9278	18.4524 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9808	0.9719	0.9505	0.8978	0.7905	0.6072	0.4239	0.4676	0.7235	0.9127	0.9689	0.9836	(94)
Useful gains	663.7023	710.4916	746.7375	754.4502	686.2845	511.8055	341.6387	358.1697	521.5618	611.1478	624.0968	638.3637	(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	1447.9011	1403.1332	1272.4845	1064.3856	817.1093	541.2617	346.2361	365.2867	585.9468	896.0990	1193.8631	1443.5647	(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	583.4439	465.4552	391.1557	223.1535	97.3336	0.0000	0.0000	0.0000	0.0000	212.0037	410.2317	599.0696	(98)
Space heating												2981.8469	(98)
Space heating per m2												32.0767	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3313.1632	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	583.4439	465.4552	391.1557	223.1535	97.3336	0.0000	0.0000	0.0000	0.0000	212.0037	410.2317	599.0696	(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)	648.2710	517.1724	434.6175	247.9484	108.1484	0.0000	0.0000	0.0000	0.0000	235.5597	455.8130	665.6329	(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	155.8453	117.0497	94.2084	50.8518	24.0046	8.7645	3.3477	31.9998	54.2824	98.2752	133.2295	154.8867	(64)	
Efficiency of water heater	(217)m	89.2836	89.3169	89.3400	89.3687	89.3274	86.7000	86.7000	86.7000	88.9279	89.1680	86.7000	(216)	
Fuel for water heating, kWh/month	174.5509	131.0499	105.4493	56.9011	26.8726	10.1090	3.8613	36.9087	62.6095	110.5110	149.4141	173.4420	(219)	
Water heating fuel used												1041.6795	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3313.1632	(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)													432.3329	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 0.81 * 908 * 1.00) =										-588.2895		-588.2895	(233)	
Total delivered energy for all uses												4323.8860	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3313.1632	3.4800	115.2981	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1041.6795	3.4800	36.2504	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	432.3329	13.1900	57.0247	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-588.2895	13.1900	-77.5954	(252)
Total energy cost			267.4653	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200	(256)
Energy cost factor (ECF)			0.8143	(257)
SAP value			88.6411	
SAP rating (Section 12)			89	(258)
SAP band			B	

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3313.1632	0.2160	715.6433	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1041.6795	0.2160	225.0028	(264)
Space and water heating			940.6460	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	432.3329	0.5190	224.3808	(268)
Energy saving/generation technologies				
PV Unit	-588.2895	0.5190	-305.3223	(269)
Total kg/year			924.5795	(272)
CO2 emissions per m2			9.9500	(273)
EI value			91.0196	
EI rating			91	(274)
EI band			B	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.4800 (1b)	x 2.3100 (2b)	= 107.3688 (1b) - (3b)
First floor	46.4800 (1c)	x 2.4700 (2c)	= 114.8056 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	92.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 222.1744 (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) =	0.1350 (8)							
Pressure test										Yes														
Measured/design AP50										4.0600														
Infiltration rate										0.3380 (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) =					0.2873 (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													0.3017	0.2801	0.2873	0.2730	0.2730	0.2658	0.2586	0.2514	0.2442	0.2658	0.2514	0.2658 (22b)
Effective ac													0.5455	0.5392	0.5413	0.5373	0.5373	0.5353	0.5334	0.5316	0.5298	0.5353	0.5316	0.5353 (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			6.2900	0.9000	5.6610		(26)
Windows (Uw = 1.40)			10.5600	1.3258	14.0000		(27)
Half Glaze Door			2.1200	1.3000	2.7560		(26a)
Jet Floor Lo			46.4800	0.1400	6.5072	75.0000	3486.0000 (28a)
100mm Knauf Supafil	60.9000	18.9700	41.9300	0.2500	10.4825	60.0000	2515.8000 (29a)
E-WM-28	1.9700		1.9700	0.3000	0.5910	110.0000	216.7000 (29a)
Plane	46.4800		46.4800	0.1300	6.0424	9.0000	418.3200 (30)
Total net area of external elements Aum(A, m ²)			155.8300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.0401		(33)
E-WM-28			75.0800	0.0000	0.0000	110.0000	8258.8000 (32)
GF - Timber			51.9300			9.0000	467.3700 (32c)
GF - Masonry			22.8700			39.0000	891.9300 (32c)
1F - Timber			82.2700			9.0000	740.4300 (32c)
Internal Floor 1			46.4800			18.0000	836.6400 (32d)
Internal Ceiling 1			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		18668.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.8243 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.4082 (36)
Total fabric heat loss					(33) + (36) =		60.4483 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.9954	Feb 39.5357	Mar 39.6852	Apr 39.3901	May 39.3901	Jun 39.2482	Jul 39.1101	Aug 38.9759	Sep 38.8453	Oct 39.2482	Nov 38.9759	Dec 39.2482 (38)
Heat transfer coeff	100.4437	99.9840	100.1335	99.8384	99.8384	99.6965	99.5585	99.4242	99.2936	99.6965	99.4242	99.6965 (39)
Average = Sum(39)m / 12 =												99.7523 (39)
HLP	Jan 1.0805	Feb 1.0756	Mar 1.0772	Apr 1.0740	May 1.0740	Jun 1.0725	Jul 1.0710	Aug 1.0695	Sep 1.0681	Oct 1.0725	Nov 1.0695	Dec 1.0725 (40)
HLP (average)												1.0731 (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												2.6641 (42)
Average daily hot water use (litres/day)												97.4725 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy conte	107.2198	103.3209	99.4220	95.5231	91.6242	87.7253	87.7253	91.6242	95.5231	99.4220	103.3209	107.2198 (44)
Energy content (annual)	159.0039	139.0658	143.5034	125.1098	120.0458	103.5904	95.9917	110.1519	111.4675	129.9046	141.8010	153.9867 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum (45)m =		1533.6226 (45)
	23.8506	20.8599	21.5255	18.7665	18.0069	15.5386	14.3988	16.5228	16.7201	19.4857	21.2702	23.0980 (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	21.8494	19.7149	21.7775	20.9933	21.6337	20.8673	21.5203	21.5938	20.9360	21.7180	21.0914	21.8273 (61)
Total heat required for water heating calculated for each month	180.8532	158.7807	165.2810	146.1031	141.6795	124.4578	117.5120	131.7457	132.4035	151.6226	162.8925	175.8140 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1208.1510 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2029.6937 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3235 (H8)
Utilisation factor												0.5303 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												97.4725 (H14)
Volume ratio Veff/V												0.7694 (H15)
Solar storage volume factor												0.9476 (H16)
Solar input	-29.2546	-41.5981	-71.4972	-96.4662	-113.3054	-121.0280	-118.4828	-106.0457	-83.0265	-57.4016	-34.6004	-896.7622 (H17)
Solar input (sum of months) = Sum (63)m =												-24.0558 (63)
Output from w/h	151.5987	117.1826	93.7838	49.6369	28.3741	3.4297	0.0000	25.7001	49.3770	94.2210	128.2920	151.7583 (64)
Total per year (kWh/year) = Sum (64)m =												893.3542 (64)
Heat gains from water heating, kWh/month	58.3311	51.1681	53.1593	46.8473	45.3237	39.6606	37.2973	42.0240	42.2969	48.6228	52.4217	56.6574 (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	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464	159.8464 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	61.2012	54.3584	44.2072	33.4677	25.0175	21.1208	22.8218	29.6646	39.8158	50.5553	59.0055	62.9022 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	364.8048	368.5903	359.0509	338.7426	313.1070	289.0132	272.9170	269.1315	278.6709	298.9792	324.6148	348.7086 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487	53.6487 (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)	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643	-106.5643 (71)
Water heating gains (Table 5)	78.4020	76.1430	71.4506	65.0657	60.9189	55.0842	50.1308	56.4838	58.7457	65.3532	72.8079	76.1524 (72)
Total internal gains	614.3389	609.0225	584.6396	547.2069	508.9743	475.1491	455.8005	465.2109	487.1634	524.8186	566.3591	597.6941 (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					4.5000	25.1925	0.6200	0.7000			0.7700	34.0963 (76)
West					6.0600	25.1925	0.6200	0.7000			0.7700	45.9164 (80)

Solar gains	80.0127	133.1407	220.4350	322.0865	373.9862	415.3731	392.5456	346.3458	270.3293	170.3165	99.4386	64.6770 (83)
Total gains	694.3516	742.1633	805.0746	869.2934	882.9605	890.5223	848.3461	811.5566	757.4927	695.1351	665.7977	662.3711 (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	51.6282	51.8656	51.7882	51.9412	51.9412	52.0152	52.0873	52.1576	52.2262	52.0152	52.1576	52.0152
alpha	4.4419	4.4577	4.4525	4.4627	4.4627	4.4677	4.4725	4.4772	4.4817	4.4677	4.4772	4.4677
util living area	0.9865	0.9810	0.9621	0.9102	0.8004	0.6042	0.4501	0.4685	0.7319	0.9206	0.9751	0.9884 (86)
MIT	19.8679	19.9766	20.2376	20.5659	20.8274	20.9632	20.9921	20.9908	20.9134	20.6141	20.2048	19.8558 (87)
Th 2	20.0168	20.0208	20.0195	20.0221	20.0221	20.0234	20.0246	20.0258	20.0269	20.0234	20.0258	20.0234 (88)
util rest of house	0.9830	0.9760	0.9518	0.8850	0.7454	0.5139	0.3413	0.3561	0.6493	0.8922	0.9674	0.9853 (89)
MIT 2	18.5299	18.6897	19.0628	19.5213	19.8567	19.9997	20.0217	20.0224	19.9608	19.5965	19.0245	18.5173 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	18.8110	18.9601	19.3096	19.7407	20.0607	20.2021	20.2256	20.2259	20.1609	19.8103	19.2725	18.7985 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6610	18.8101	19.1596	19.5907	19.9107	20.0521	20.0756	20.0759	20.0109	19.6603	19.1225	18.6485 (93)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9761	0.9675	0.9400	0.8717	0.7383	0.5167	0.3471	0.3620	0.6478	0.8790	0.9575	0.9790	(94)
Useful gains	677.7258	718.0800	756.7807	757.7267	651.9221	460.1151	294.4973	293.8121	490.6995	611.0097	637.5178	648.4690	(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	1382.2069	1350.7938	1217.5876	1007.4442	739.8682	473.7709	296.2468	295.8725	527.3402	823.5258	1115.7852	1360.7092	(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	524.1339	425.1836	342.8404	179.7966	65.4319	0.0000	0.0000	0.0000	0.0000	158.1120	344.3525	529.9067	(98)
Space heating												2569.7577	(98)
Space heating per m2											(98) / (4) =	27.6437	(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													2855.2863 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	524.1339	425.1836	342.8404	179.7966	65.4319	0.0000	0.0000	0.0000	0.0000	158.1120	344.3525	529.9067	(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)	582.3710	472.4263	380.9338	199.7740	72.7021	0.0000	0.0000	0.0000	0.0000	175.6800	382.6139	588.7853	(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	151.5987	117.1826	93.7838	49.6369	28.3741	3.4297	0.0000	25.7001	49.3770	94.2210	128.2920	151.7583	(64)
Efficiency of water heater	89.2380	89.2659	89.2702	89.2649	88.9756	86.7000	86.7000	86.7000	86.7000	88.7388	89.0797	86.7000	(216)
(217)m	89.2380	89.2659	89.2702	89.2649	88.9756	86.7000	86.7000	86.7000	86.7000	88.7388	89.0797	86.7000	(217)
Fuel for water heating, kWh/month	169.8813	131.2736	105.0561	55.6063	31.8898	3.9558	0.0000	29.6425	56.9516	106.1779	144.0194	170.0492	(219)
Water heating fuel used												1004.5035	(219)
Annual totals kWh/year													
Space heating fuel - main system												2855.2863	(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)													432.3329 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.81 * 1031 * 1.00) =										-668.0993		-668.0993	(233)
Total delivered energy for all uses												3749.0234	(238)

10a. Fuel costs - using BEDF prices (445)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2855.2863	3.9300	112.2128	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1004.5035	3.9300	39.4770	(247)
Pumps and fans for heating	75.0000	17.5600	13.1700	(249)
Pump for solar water heating	50.0000	17.5600	8.7800	(249)
Energy for lighting	432.3329	17.5600	75.9176	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-668.0993	17.5600	-117.3182	(252)
Total energy cost			220.2392	(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	2855.2863	0.2160	616.7418	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1004.5035	0.2160	216.9728	(264)
Space and water heating			833.7146	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	432.3329	0.5190	224.3808	(268)
Energy saving/generation technologies				

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PV Unit	-668.0993	0.5190	-346.7435 (269)
Total kg/year			776.2268 (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	2855.2863	1.2200	3483.4493 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1004.5035	1.2200	1225.4943 (264)
Space and water heating			4708.9436 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	432.3329	3.0700	1327.2619 (268)
Energy saving/generation technologies			
PV Unit	-668.0993	3.0700	-2051.0649 (269)
Primary energy kWh/year			4368.8906 (272)
Primary energy kWh/m2/year			46.9975 (273)

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

Overheating Calculation Input Data

Dwelling type	MidTerrace House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Southern England
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	200.8 (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	293.27 (P1)
Transmission heat loss coefficient	60.45 (37)
Summer heat loss coefficient	353.72 (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 or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	4.5000	125.2818	0.6200	0.7000	0.9000	198.1870
West	6.0600	125.2818	0.6200	0.7000	0.9000	266.8918
total:						465.0789

	Jun	Jul	Aug	
Solar gains	500	465	409	(P3)
Internal gains	472	453	462	
Total summer gains	972	918	871	(P5)
Summer gain/loss ratio	2.75	2.59	2.46	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 200.8)	0.59	0.59	0.59	
Threshold temperature	18.74	20.49	20.36	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	
Assessment of likelihood of high internal temperature:	Not significant			