

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-133			Issued on Date	15/03/2018
Assessment Reference	As Built	Prop Type Ref	SHL3 - Mid (Op)		
Property	9, Kiln Row, Botley, SOUTHAMPTON, SO32 2GF				
SAP Rating	87 B	DER	13.91	TER	17.04
Environmental	89 B	% DER<TER	18.38		
CO ₂ Emissions (t/year)	1.00	DFEE	40.86	TFEE	47.29
General Requirements Compliance	Pass	% DFEE<TFEE	13.60		
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) 17.04 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.91 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)47.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.9 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.14 (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: 3.95 (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): Slight 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
Air permeability 4.0 m³/m²h
Photovoltaic array 0.54 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					3.9500
Infiltration rate					0.3325 (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) =	0.2826 (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	0.3604	0.3533	0.3462	0.3109	0.3038	0.2685	0.2685	0.2615	0.2826	0.3038	0.3180	0.3321 (22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5462	0.5361	0.5361	0.5342	0.5399	0.5462	0.5506	0.5551 (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	52.1000	18.9700	33.1300	0.2500	8.2825	60.0000	1987.8000 (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)			145.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2491		(33)
E-WM-28			84.9900	0.0000	0.0000	110.0000	9348.9000 (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			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19014.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.5399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4993 (36)
Total fabric heat loss						(33) + (36) =	52.7484 (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	41.4197	41.2349	41.0537	40.2025	40.0433	39.3019	39.3019	39.1646	39.5875	40.0433	40.3654	40.7022 (38)
Heat transfer coeff	94.1682	93.9833	93.8021	92.9509	92.7917	92.0503	92.0503	91.9131	92.3359	92.7917	93.1138	93.4506 (39)
Average = Sum(39)m / 12 =												92.9502 (39)
HLP	1.0130	1.0110	1.0091	0.9999	0.9982	0.9902	0.9902	0.9887	0.9933	0.9982	1.0017	1.0053 (40)
HLP (average)												0.9999 (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)

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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												
	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)
Heat gains from water heating, kWh/month								Total per year (kWh/year) = Sum (64)m =				1789.1456 (64)
	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	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				Solar flux		g		FF		Access		Gains
	m2				Table 6a		Table 6b		factor		factor		W
					W/m2		or Table 6b		or Table 6c		Table 6d		
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 (76)
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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	56.0877	56.1980	56.3066	56.8222	56.9197	57.3781	57.3781	57.4638	57.2007	56.9197	56.7228	56.5183
alpha	4.7392	4.7465	4.7538	4.7881	4.7946	4.8252	4.8252	4.8309	4.8134	4.7946	4.7815	4.7679
util living area												
	0.9976	0.9954	0.9887	0.9654	0.8990	0.7565	0.5912	0.6476	0.8761	0.9795	0.9955	0.9981 (86)
MIT	19.6654	19.8051	20.0631	20.4110	20.7215	20.9187	20.9806	20.9703	20.8223	20.4165	19.9782	19.6382 (87)
Th 2	20.0725	20.0742	20.0758	20.0834	20.0848	20.0915	20.0915	20.0927	20.0889	20.0848	20.0820	20.0789 (88)
util rest of house												
	0.9969	0.9941	0.9854	0.9542	0.8651	0.6798	0.4804	0.5372	0.8219	0.9709	0.9940	0.9976 (89)
MIT 2	18.2728	18.4778	18.8544	19.3596	19.7859	20.0274	20.0821	20.0769	19.9248	19.3742	18.7367	18.2375 (90)
Living area fraction												
	18.5654	18.7567	19.1084	19.5805	19.9825	20.2146	20.2709	20.2646	20.1133	19.5932	18.9975	18.5318 (92)
MIT												
Temperature adjustment												-0.1500
adjusted MIT	18.4154	18.6067	18.9584	19.4305	19.8325	20.0646	20.1209	20.1146	19.9633	19.4432	18.8475	18.3818 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9951	0.9911	0.9795	0.9438	0.8539	0.6773	0.4841	0.5400	0.8129	0.9624	0.9909	0.9961 (94)
Useful gains	473.2924	528.0679	584.4110	627.0959	602.6982	467.9013	318.6155	332.2927	456.0796	477.9766	453.4877	450.4346 (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												
	1329.2166	1288.2002	1168.6210	978.8212	754.6242	503.0205	324.0957	341.4164	541.3948	820.5758	1093.8539	1325.2938 (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												
	636.8076	510.8089	434.6522	253.2422	113.0329	0.0000	0.0000	0.0000	0.0000	254.8938	461.0636	650.8952 (98)
Space heating												3315.3966 (98)
Space heating per m2												(98) / (4) = 35.6648 (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													3683.7740	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	636.8076	510.8089	434.6522	253.2422	113.0329	0.0000	0.0000	0.0000	0.0000	254.8938	461.0636	650.8952	(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)	707.5640	567.5654	482.9469	281.3803	125.5921	0.0000	0.0000	0.0000	0.0000	283.2153	512.2929	723.2169	(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	89.2486	89.1949	89.0660	88.7639	88.1341	86.7000	86.7000	86.7000	86.7000	88.7402	89.1145	89.2773	(216)	
Fuel for water heating, kWh/month	202.6398	178.0153	185.5712	164.5974	160.7545	143.5499	135.5386	151.9559	152.7145	170.8613	182.7901	196.9302	(219)	
Water heating fuel used												2025.9187	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3683.7740	(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 * 0.54 * 908 * 1.00) =										-392.1930			-392.1930	(233)
Total delivered energy for all uses													5824.8325	(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	3683.7740	0.2160	795.6952	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2025.9187	0.2160	437.5984	(264)
Space and water heating			1233.2936	(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	-392.1930	0.5190	-203.5482	(269)
Total CO2, kg/year			1293.0512	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.9100	(273)

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

DER			13.9100	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			31.4586	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			31.4586	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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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	=	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							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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			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	52.1000	18.9700	33.1300	0.1800	5.9634			(29a)					
Plane	46.4800		46.4800	0.1300	6.0424			(30)					
Total net area of external elements Aum(A, m2)			145.0600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.8822			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3909	(36)					
Total fabric heat loss						(33) + (36) =	51.2731	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 43.0418	Feb 42.7939	Mar 42.5509	Apr 41.4098	May 41.1963	Jun 40.2024	Jul 40.2024	Aug 40.0184	Sep 40.5853	Oct 41.1963	Nov 41.6282	Dec 42.0798	(38)
Heat transfer coeff	94.3149	94.0670	93.8240	92.6829	92.4694	91.4755	91.4755	91.2915	91.8584	92.4694	92.9013	93.3529	(39)
Average = Sum(39)m / 12 =												92.6819	(39)
HLP	Jan 1.0146	Feb 1.0119	Mar 1.0093	Apr 0.9970	May 0.9947	Jun 0.9840	Jul 0.9840	Aug 0.9821	Sep 0.9881	Oct 0.9947	Nov 0.9994	Dec 1.0042	(40)
HLP (average)												0.9970	(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	Jan 107.2198	Feb 103.3209	Mar 99.4220	Apr 95.5231	May 91.6242	Jun 87.7253	Jul 87.7253	Aug 91.6242	Sep 95.5231	Oct 99.4220	Nov 103.3209	Dec 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	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)

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CALCULATION OF TARGET EMISSIONS 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	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.6644	47.1073	46.6907	43.2618	44.7038	46.6907	47.1073	50.6644	49.3151	50.9589	50.9589	50.9589	(61)
Total heat required for water heating calculated for each 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	204.9457	204.9457	(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	0.0000	0.0000	(63)
Output from w/h	209.9628	185.0932	194.1678	172.2171	166.7365	146.8522	140.6956	156.8426	158.5748	180.5690	191.1161	204.9457	204.9457	204.9457	(64)
Heat gains from water heating, kWh/month	65.6085	57.7462	60.3810	53.3758	51.5879	45.2593	43.0932	48.2982	48.8398	55.8594	59.4776	63.9403	63.9403	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]												Gains
				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	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	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	68.4469	68.6272	68.8049	69.6521	69.8129	70.5714	70.5714	70.7137	70.2773	69.8129	69.4883	69.1522	(86)
alpha	5.5631	5.5751	5.5870	5.6435	5.6542	5.7048	5.7048	5.7142	5.6852	5.6542	5.6326	5.6101	(87)
util living area	0.9990	0.9979	0.9937	0.9760	0.9140	0.7623	0.5860	0.6443	0.8892	0.9869	0.9979	0.9993	(88)
MIT	19.8719	19.9936	20.2175	20.5225	20.7902	20.9496	20.9906	20.9845	20.8714	20.5221	20.1444	19.8523	(89)
Th 2	20.0712	20.0734	20.0756	20.0858	20.0877	20.0967	20.0967	20.0983	20.0932	20.0877	20.0839	20.0798	(90)
util rest of house	0.9987	0.9971	0.9914	0.9665	0.8794	0.6804	0.4726	0.5299	0.8322	0.9802	0.9970	0.9990	(91)
MIT 2	18.5515	18.7312	19.0591	19.5055	19.8709	20.0609	20.0929	20.0914	19.9820	19.5111	18.9596	18.5292	(92)
Living area fraction	18.8289	18.9964	19.3024	19.7192	20.0640	20.2476	20.2815	20.2790	20.1689	19.7235	19.2085	18.8072	(93)
Temperature adjustment												0.0000	(94)
adjusted MIT	18.8289	18.9964	19.3024	19.7192	20.0640	20.2476	20.2815	20.2790	20.1689	19.7235	19.2085	18.8072	(95)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	485.4411	542.3317	602.7010	652.1464	632.4638	489.7887	333.4638	348.1708	480.8197	496.7310	466.7173	462.1101	(96)
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	(97)
Heat loss rate W	1370.2921	1326.0051	1201.1770	1002.7541	773.4180	516.6152	336.7693	354.1199	557.4776	843.6434	1124.8998	1363.6242	(98)
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	(99a)
Space heating kWh	658.3291	526.6285	445.2661	252.4375	104.8699	0.0000	0.0000	0.0000	0.0000	258.1028	473.8914	670.7265	(98)
Space heating												3390.2520	(98)
Space heating per m2												36.4700	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3629.8201 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	658.3291	526.6285	445.2661	252.4375	104.8699	0.0000	0.0000	0.0000	0.0000	258.1028	473.8914	670.7265 (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)	704.8492	563.8421	476.7303	270.2757	112.2804	0.0000	0.0000	0.0000	0.0000	276.3413	507.3784	718.1226 (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	87.7317	87.5366	87.0743	86.0126	83.9202	80.3000	80.3000	80.3000	80.3000	85.9500	87.2463	80.3000 (216)
Fuel for water heating, kWh/month	239.3238	211.4465	222.9908	200.2231	198.6846	182.8794	175.2124	195.3208	197.4779	210.0859	219.0536	233.3836 (219)
Water heating fuel used												2486.0825 (219)
Annual totals kWh/year												
Space heating fuel - main system												3629.8201 (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												6623.2355 (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	3629.8201	0.2160	784.0411 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2486.0825	0.2160	536.9938 (264)
Space and water heating			1321.0350 (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			1584.3407 (272)
Emissions per m2 for space and water heating			14.2108 (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) = (14.2108 * 1.00) + 2.4137 + 0.4187, rounded to 2 d.p.			17.0400 (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 heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					3.9500
Infiltration rate					0.3325 (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) =	0.2826 (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	0.3604	0.3533	0.3462	0.3109	0.3038	0.2685	0.2685	0.2615	0.2826	0.3038	0.3180	0.3321 (22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5462	0.5361	0.5361	0.5342	0.5399	0.5462	0.5506	0.5551 (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	52.1000	18.9700	33.1300	0.2500	8.2825	60.0000	1987.8000 (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)			145.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2491		(33)
E-WM-28			84.9900	0.0000	0.0000	110.0000	9348.9000 (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			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			9.0000	418.3200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18595.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							200.0399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4993 (36)
Total fabric heat loss						(33) + (36) =	52.7484 (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	41.4197	41.2349	41.0537	40.2025	40.0433	39.3019	39.3019	39.1646	39.5875	40.0433	40.3654	40.7022 (38)
Heat transfer coeff	94.1682	93.9833	93.8021	92.9509	92.7917	92.0503	92.0503	91.9131	92.3359	92.7917	93.1138	93.4506 (39)
Average = Sum(39)m / 12 =												92.9502 (39)
HLP	1.0130	1.0110	1.0091	0.9999	0.9982	0.9902	0.9902	0.9887	0.9933	0.9982	1.0017	1.0053 (40)
HLP (average)												0.9999 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	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 (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	439.6541	497.6612	563.1542	633.3168	676.2253	663.3149	632.4200	587.3019	532.2188	465.3963	423.6852	417.0356 (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	54.8537	54.9616	55.0678	55.5721	55.6674	56.1158	56.1158	56.1996	55.9422	55.6674	55.4748	55.2749	
alpha	4.6569	4.6641	4.6712	4.7048	4.7112	4.7411	4.7411	4.7466	4.7295	4.7112	4.6983	4.6850	
util living area	0.9981	0.9962	0.9904	0.9695	0.9087	0.7735	0.6103	0.6700	0.8907	0.9831	0.9965	0.9985	(86)
MIT	19.5981	19.7415	20.0070	20.3667	20.6918	20.9055	20.9763	20.9635	20.7975	20.3704	19.9189	19.5712	(87)
Th 2	20.0725	20.0742	20.0758	20.0834	20.0848	20.0915	20.0915	20.0927	20.0889	20.0848	20.0820	20.0789	(88)
util rest of house	0.9976	0.9952	0.9875	0.9596	0.8774	0.6988	0.4979	0.5590	0.8409	0.9759	0.9953	0.9981	(89)
MIT 2	18.7783	18.9227	19.1881	19.5480	19.8557	20.0393	20.0834	20.0789	19.9580	19.5565	19.1062	18.7565	(90)
Living area fraction	18.9505	19.0947	19.3601	19.7200	20.0313	20.2213	20.2710	20.2648	20.1343	19.7275	19.2770	18.9277	(91)
MIT	18.9505	19.0947	19.3601	19.7200	20.0313	20.2213	20.2710	20.2648	20.1343	19.7275	19.2770	18.9277	(92)
Temperature adjustment	18.9505	19.0947	19.3601	19.7200	20.0313	20.2213	20.2710	20.2648	20.1343	19.7275	19.2770	18.9277	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	438.1943	494.5104	554.4860	604.6512	591.8462	471.2970	329.6272	341.5584	449.1028	452.4871	421.0739	415.9529	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1379.6143	1334.0655	1206.3070	1005.7294	773.0764	517.4416	337.9151	355.2249	557.1854	846.9526	1133.8446	1376.3120	(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	700.4165	564.1811	484.9548	288.7763	134.8353	0.0000	0.0000	0.0000	0.0000	293.4823	513.1949	714.5071	(98)
Space heating													3694.3484 (98)
Space heating per m2													39.7413 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	865.2732	681.1725	698.5392	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8315	0.8997	0.8721	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	719.4889	612.8542	609.1628	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	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)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	113.7025	168.4353	133.5385	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												415.6762 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	28.4256	42.1088	33.3846	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												103.9191 (107)
Space cooling per m2												1.1179 (108)
Energy for space heating												39.7413 (99)
Energy for space cooling												1.1179 (108)
Total												40.8592 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.9 (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	=	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							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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			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	52.1000	18.9700	33.1300	0.1800	5.9634			(29a)					
Plane	46.4800		46.4800	0.1300	6.0424			(30)					
Total net area of external elements Aum(A, m2)			145.0600					(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	40.8822		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3909	(36)					
Total fabric heat loss						(33) + (36) =	51.2731	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 43.0418	Feb 42.7939	Mar 42.5509	Apr 41.4098	May 41.1963	Jun 40.2024	Jul 40.2024	Aug 40.0184	Sep 40.5853	Oct 41.1963	Nov 41.6282	Dec 42.0798	(38)
Heat transfer coeff	94.3149	94.0670	93.8240	92.6829	92.4694	91.4755	91.4755	91.2915	91.8584	92.4694	92.9013	93.3529	(39)
Average = Sum(39)m / 12 =												92.6819	(39)
HLP	Jan 1.0146	Feb 1.0119	Mar 1.0093	Apr 0.9970	May 0.9947	Jun 0.9840	Jul 0.9840	Aug 0.9821	Sep 0.9881	Oct 0.9947	Nov 0.9994	Dec 1.0042	(40)
HLP (average)												0.9970	(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	Jan 107.2198	Feb 103.3209	Mar 99.4220	Apr 95.5231	May 91.6242	Jun 87.7253	Jul 87.7253	Aug 91.6242	Sep 95.5231	Oct 99.4220	Nov 103.3209	Dec 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	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)

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	(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	(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	0.6300	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	68.4469	68.6272	68.8049	69.6521	69.8129	70.5714	70.5714	70.7137	70.2773	69.8129	69.4883	69.1522	
alpha	5.5631	5.5751	5.5870	5.6435	5.6542	5.7048	5.7048	5.7142	5.6852	5.6542	5.6326	5.6101	
util living area	0.9994	0.9986	0.9956	0.9817	0.9290	0.7886	0.6132	0.6770	0.9117	0.9912	0.9987	0.9996	(86)
MIT	19.8247	19.9475	20.1741	20.4855	20.7647	20.9399	20.9883	20.9802	20.8489	20.4822	20.0994	19.8058	(87)
Th 2	20.0712	20.0734	20.0756	20.0858	20.0877	20.0967	20.0967	20.0983	20.0932	20.0877	20.0839	20.0798	(88)
util rest of house	0.9992	0.9981	0.9940	0.9741	0.8986	0.7084	0.4964	0.5600	0.8616	0.9865	0.9982	0.9994	(89)
MIT 2	18.9865	19.1110	19.3387	19.6543	19.9185	20.0668	20.0934	20.0921	20.0008	19.6553	19.2715	18.9747	(90)
Living area fraction									fLA = Living area / (4) =			0.2101	(91)
MIT	19.1626	19.2868	19.5142	19.8289	20.0963	20.2502	20.2814	20.2787	20.1790	19.8290	19.4454	19.1493	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1626	19.2868	19.5142	19.8289	20.0963	20.2502	20.2814	20.2787	20.1790	19.8290	19.4454	19.1493	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	440.1765	498.4090	562.2145	619.8050	613.0751	484.1142	332.5498	346.3034	464.8456	460.5464	423.9417	417.5253	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1401.7652	1353.3215	1221.0432	1012.9262	776.3991	516.8556	336.7585	354.0879	558.4077	853.4020	1146.9063	1395.5616	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	715.4220	574.5012	490.1685	283.0472	121.5131	0.0000	0.0000	0.0000	0.0000	292.2846	520.5345	727.6590	(98)
Space heating												3725.1301	(98)
Space heating per m2												40.0724	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	859.8699	676.9188	693.8151	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8625	0.9277	0.9021	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	741.6578	628.0061	625.9118	0.0000	0.0000	0.0000	0.0000	(102)
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	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	102.7317	162.0722	125.2948	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												390.0986	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction											FC = cooled area / (4) =	1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	25.6829	40.5180	31.3237	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												97.5247 (107)
Space cooling per m2												1.0491 (108)
Energy for space heating												40.0724 (99)
Energy for space cooling												1.0491 (108)
Total												41.1215 (109)
Target Fabric Energy Efficiency (TFEE)												47.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					3.9500
Infiltration rate					0.3325 (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)	=	0.2826 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	3.9000	4.0000	3.8000	3.8000	3.7000	3.6000	3.5000	3.4000	3.7000	3.5000	3.7000 (22)
Wind factor	1.0500	0.9750	1.0000	0.9500	0.9500	0.9250	0.9000	0.8750	0.8500	0.9250	0.8750	0.9250 (22a)
Adj infilt rate												
Effective ac	0.2968	0.2756	0.2826	0.2685	0.2685	0.2615	0.2544	0.2473	0.2403	0.2615	0.2473	0.2615 (22b)
	0.5440	0.5380	0.5399	0.5361	0.5361	0.5342	0.5324	0.5306	0.5289	0.5342	0.5306	0.5342 (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	52.1000	18.9700	33.1300	0.2500	8.2825	60.0000	1987.8000 (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)			145.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2491		(33)
E-WM-28			84.9900	0.0000	0.0000	110.0000	9348.9000 (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			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19014.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.5399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4993 (36)
Total fabric heat loss						(33) + (36) =	52.7484 (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	39.8877	39.4429	39.5875	39.3019	39.3019	39.1646	39.0310	38.9011	38.7748	39.1646	38.9011	39.1646 (38)
Heat transfer coeff	92.6361	92.1913	92.3359	92.0503	92.0503	91.9131	91.7794	91.6495	91.5232	91.9131	91.6495	91.9131 (39)
Average = Sum(39)m / 12 =												91.9671 (39)
HLP	0.9965	0.9917	0.9933	0.9902	0.9902	0.9887	0.9873	0.9859	0.9845	0.9887	0.9859	0.9887 (40)
HLP (average)												0.9893 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	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	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)
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	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	or Table 6b	or Table 6c	factor	W
													W/m2			Table 6d	
East												4.5000	25.1925	0.6200	0.7000	0.7700	34.0963
West												6.0600	25.1925	0.6200	0.7000	0.7700	45.9164
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	57.0153	57.2904	57.2007	57.3781	57.3781	57.4638	57.5475	57.6291	57.7086	57.4638	57.6291	57.4638
alpha	4.8010	4.8194	4.8134	4.8252	4.8252	4.8309	4.8365	4.8419	4.8472	4.8309	4.8419	4.8309
util living area	0.9862	0.9801	0.9588	0.8987	0.7747	0.5688	0.4181	0.4357	0.7004	0.9107	0.9735	0.9882 (86)
MIT	20.0161	20.1209	20.3643	20.6613	20.8799	20.9787	20.9961	20.9953	20.9437	20.6954	20.3246	20.0030 (87)
Th 2	20.0862	20.0902	20.0889	20.0915	20.0915	20.0927	20.0939	20.0951	20.0962	20.0927	20.0951	20.0927 (88)
util rest of house	0.9826	0.9750	0.9478	0.8722	0.7197	0.4862	0.3230	0.3371	0.6209	0.8807	0.9654	0.9851 (89)
MIT 2	18.7920	18.9458	19.2925	19.7037	19.9781	20.0792	20.0925	20.0934	20.0541	19.7585	19.2447	18.7779 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	19.0491	19.1927	19.5177	19.9049	20.1676	20.2682	20.2823	20.2829	20.2410	19.9553	19.4716	19.0353 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8991	19.0427	19.3677	19.7549	20.0176	20.1182	20.1323	20.1329	20.0910	19.8053	19.3216	18.8853 (93)

8. Space heating requirement

Utilisation	0.9762	0.9671	0.9369	0.8606	0.7147	0.4886	0.3271	0.3412	0.6204	0.8691	0.9562	0.9793 (94)
Useful gains	677.8376	717.7209	754.2697	748.1018	631.0918	435.1030	277.4521	276.9395	469.9531	604.1615	636.6286	648.6675 (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	1296.8254	1266.9546	1141.9809	943.9629	691.9962	442.8548	278.3060	277.9618	493.3982	772.5590	1046.7820	1276.2413 (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	460.5269	369.0851	288.4572	141.0200	45.3128	0.0000	0.0000	0.0000	0.0000	125.2878	295.3105	466.9149 (98)
Space heating												2191.9151 (98)
RHI space heating demand												2192 (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 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					3.9500
Infiltration rate					0.3325 (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) =	0.2826 (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	0.3604	0.3533	0.3462	0.3109	0.3038	0.2685	0.2685	0.2615	0.2826	0.3038	0.3180	0.3321 (22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5462	0.5361	0.5361	0.5342	0.5399	0.5462	0.5506	0.5551 (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	52.1000	18.9700	33.1300	0.2500	8.2825	60.0000	1987.8000 (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)			145.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2491		(33)
E-WM-28			84.9900	0.0000	0.0000	110.0000	9348.9000 (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			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19014.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.5399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4993 (36)
Total fabric heat loss						(33) + (36) =	52.7484 (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	41.4197	41.2349	41.0537	40.2025	40.0433	39.3019	39.3019	39.1646	39.5875	40.0433	40.3654	40.7022 (38)
Heat transfer coeff	94.1682	93.9833	93.8021	92.9509	92.7917	92.0503	92.0503	91.9131	92.3359	92.7917	93.1138	93.4506 (39)
Average = Sum(39)m / 12 =												92.9502 (39)
HLP	1.0130	1.0110	1.0091	0.9999	0.9982	0.9902	0.9902	0.9887	0.9933	0.9982	1.0017	1.0053 (40)
HLP (average)												0.9999 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	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	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												
Solar input	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)
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)
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	(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	(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]												Gains	
	Area				Solar flux		g		FF		Access		W
	m2				Table 6a		Specific data		Specific data		factor		
					W/m2		or Table 6b		or Table 6c		Table 6d		
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 (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	56.0877	56.1980	56.3066	56.8222	56.9197	57.3781	57.3781	57.4638	57.2007	56.9197	56.7228	56.5183
alpha	4.7392	4.7465	4.7538	4.7881	4.7946	4.8252	4.8252	4.8309	4.8134	4.7946	4.7815	4.7679
util living area	0.9894	0.9834	0.9675	0.9232	0.8249	0.6563	0.4934	0.5376	0.7732	0.9397	0.9818	0.9913 (86)
MIT	19.9025	20.0343	20.2701	20.5747	20.8210	20.9561	20.9909	20.9865	20.9027	20.5905	20.1936	19.8719 (87)
Th 2	20.0725	20.0742	20.0758	20.0834	20.0848	20.0915	20.0915	20.0927	20.0889	20.0848	20.0820	20.0789 (88)
util rest of house	0.9867	0.9791	0.9589	0.9023	0.7792	0.5783	0.3960	0.4383	0.7037	0.9189	0.9763	0.9890 (89)
MIT 2	18.6173	18.8092	19.1492	19.5812	19.9034	20.0591	20.0874	20.0860	20.0072	19.6119	19.0472	18.5776 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	18.8873	19.0666	19.3847	19.7899	20.0962	20.2476	20.2772	20.2752	20.1953	19.8175	19.2880	18.8495 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7373	18.9166	19.2347	19.6399	19.9462	20.0976	20.1272	20.1252	20.0453	19.6675	19.1380	18.6995 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9812	0.9718	0.9487	0.8901	0.7714	0.5788	0.3999	0.4419	0.6999	0.9069	0.9686	0.9842 (94)
Ext temp.	664.0283	710.4689	745.2991	747.9412	669.6988	487.8726	322.2560	338.4861	504.5823	607.2739	623.9377	638.7323 (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	1359.5360	1317.3261	1194.5376	998.2860	765.1800	506.0537	324.6808	342.3952	548.9649	841.3888	1120.9066	1354.9859 (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	517.4577	407.8081	334.2335	180.2482	71.0380	0.0000	0.0000	0.0000	0.0000	174.1815	357.8176	532.8927 (98)
Space heating per m2												2575.6772 (98)
										(98) / (4) =		27.7074 (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													2861.8636	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	517.4577	407.8081	334.2335	180.2482	71.0380	0.0000	0.0000	0.0000	0.0000	174.1815	357.8176	532.8927	(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)	574.9530	453.1201	371.3705	200.2758	78.9312	0.0000	0.0000	0.0000	0.0000	193.5350	397.5751	592.1030	(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	89.1215	89.0501	88.8806	88.4921	87.7748	86.7000	86.7000	86.7000	86.7000	88.4335	88.9410	89.1581	(216)	
Fuel for water heating, kWh/month	202.9289	178.3048	185.9584	165.1030	161.4125	143.5499	135.5386	151.9559	152.7145	171.4538	183.1467	197.1935	(219)	
Annual totals kWh/year												2029.2605	(219)	
Space heating fuel - main system												2861.8636	(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 * 0.54 * 908 * 1.00) =										-392.1930			-392.1930	(233)
Total delivered energy for all uses													5006.2639	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2861.8636	3.4800	99.5929 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2029.2605	3.4800	70.6183 (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	-392.1930	13.1900	-51.7303 (252)
Total energy cost			305.3981 (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] =	0.9297 (257)
SAP value		87.0301
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	2861.8636	0.2160	618.1625 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2029.2605	0.2160	438.3203 (264)
Space and water heating			1056.4828 (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	-392.1930	0.5190	-203.5482 (269)
Total kg/year			1116.2404 (272)
CO2 emissions per m2			12.0100 (273)
EI value			89.1580
EI rating			89 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	$3.48 / 0.8805 = 3.952$, stars = 4
Water heating environmental impact	$0.216 / 0.8805 = 0.2453$, 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					3.9500
Infiltration rate					0.3325 (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) =	0.2826 (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	0.2968	0.2756	0.2826	0.2685	0.2685	0.2615	0.2544	0.2473	0.2403	0.2615	0.2473	0.2615 (22b)
Effective ac	0.5440	0.5380	0.5399	0.5361	0.5361	0.5342	0.5324	0.5306	0.5289	0.5342	0.5306	0.5342 (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	52.1000	18.9700	33.1300	0.2500	8.2825	60.0000	1987.8000 (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)			145.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2491		(33)
E-WM-28			84.9900	0.0000	0.0000	110.0000	9348.9000 (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			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19014.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.5399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4993 (36)
Total fabric heat loss						(33) + (36) =	52.7484 (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	39.8877	39.4429	39.5875	39.3019	39.3019	39.1646	39.0310	38.9011	38.7748	39.1646	38.9011	39.1646 (38)
Heat transfer coeff	92.6361	92.1913	92.3359	92.0503	92.0503	91.9131	91.7794	91.6495	91.5232	91.9131	91.6495	91.9131 (39)
Average = Sum(39)m / 12 =												91.9671 (39)
HLP	0.9965	0.9917	0.9933	0.9902	0.9902	0.9887	0.9873	0.9859	0.9845	0.9887	0.9859	0.9887 (40)
HLP (average)												0.9893 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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												
	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)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1789.1456 (64)
	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]												Gains
					Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF	Specific data or Table 6c	Access factor Table 6d	W
East					4.5000	25.1925		0.6200		0.7000	0.7700	34.0963
West					6.0600	25.1925		0.6200		0.7000	0.7700	45.9164 (76)

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	57.0153	57.2904	57.2007	57.3781	57.3781	57.4638	57.5475	57.6291	57.7086	57.4638	57.6291	57.4638
alpha	4.8010	4.8194	4.8134	4.8252	4.8252	4.8309	4.8365	4.8419	4.8472	4.8309	4.8419	4.8309
util living area												
	0.9862	0.9801	0.9588	0.8987	0.7747	0.5688	0.4181	0.4357	0.7004	0.9107	0.9735	0.9882 (86)
MIT	20.0161	20.1209	20.3643	20.6613	20.8799	20.9787	20.9961	20.9953	20.9437	20.6954	20.3246	20.0030 (87)
Th 2	20.0862	20.0902	20.0889	20.0915	20.0915	20.0927	20.0939	20.0951	20.0962	20.0927	20.0951	20.0927 (88)
util rest of house												
	0.9826	0.9750	0.9478	0.8722	0.7197	0.4862	0.3230	0.3371	0.6209	0.8807	0.9654	0.9851 (89)
MIT 2	18.7920	18.9458	19.2925	19.7037	19.9781	20.0792	20.0925	20.0934	20.0541	19.7585	19.2447	18.7779 (90)
Living area fraction									fLA =	Living area / (4) =		0.2101 (91)
MIT	19.0491	19.1927	19.5177	19.9049	20.1676	20.2682	20.2823	20.2829	20.2410	19.9553	19.4716	19.0353 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8991	19.0427	19.3677	19.7549	20.0176	20.1182	20.1323	20.1329	20.0910	19.8053	19.3216	18.8853 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9762	0.9671	0.9369	0.8606	0.7147	0.4886	0.3271	0.3412	0.6204	0.8691	0.9562	0.9793 (94)
Useful gains	677.8376	717.7209	754.2697	748.1018	631.0918	435.1030	277.4521	276.9395	469.9531	604.1615	636.6286	648.6675 (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												
	1296.8254	1266.9546	1141.9809	943.9629	691.9962	442.8548	278.3060	277.9618	493.3982	772.5590	1046.7820	1276.2413 (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												
	460.5269	369.0851	288.4572	141.0200	45.3128	0.0000	0.0000	0.0000	0.0000	125.2878	295.3105	466.9149 (98)
Space heating												2191.9151 (98)
Space heating per m2										(98) / (4) =		23.5791 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.0000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2435.4613	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	460.5269	369.0851	288.4572	141.0200	45.3128	0.0000	0.0000	0.0000	0.0000	125.2878	295.3105	466.9149	(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)	511.6966	410.0945	320.5080	156.6889	50.3476	0.0000	0.0000	0.0000	0.0000	139.2086	328.1228	518.7943	(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	89.0443	88.9813	88.7692	88.2900	87.4773	86.7000	86.7000	86.7000	86.7000	88.1626	88.7984	89.0726	(216)	
Fuel for water heating, kWh/month	203.1047	178.4428	186.1917	165.4809	161.9615	143.5499	135.5386	151.9559	152.7145	171.9807	183.4407	197.3828	(219)	
Water heating fuel used												2031.7449	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2435.4613	(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 * 0.54 * 1031 * 1.00) =										-445.3995			-445.3995	(233)
Total delivered energy for all uses													4529.1395	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2435.4613	3.9300	95.7136 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2031.7449	3.9300	79.8476 (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	-445.3995	17.5600	-78.2122 (252)
Total energy cost			274.4367 (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	2435.4613	0.2160	526.0596 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2031.7449	0.2160	438.8569 (264)
Space and water heating			964.9165 (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	-445.3995	0.5190	-231.1624 (269)
Total kg/year			997.0599 (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	2435.4613	1.2200	2971.2627 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2031.7449	1.2200	2478.7288 (264)
Space and water heating			5449.9915 (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	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			5640.1268 (272)
Primary energy kWh/m2/year			60.6726 (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:			
N	Solar water heating	SAP change + 1.2	Cost change -£ 32
			CO2 change -196 kg (19.6%)

		Typical annual savings		Energy efficiency	Environmental impact
Recommended measures					
Solar water heating		£32	2.11 kg/m²	B 88	B 91
Total Savings		£32	2.11 kg/m²		
Potential energy efficiency rating:				B 88	
Potential environmental impact rating:					B 91

Fuel prices for cost data on this page from database revision number 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	£264	£223	£40
Space heating	£197	£197	£0
Water heating	£80	£48	£32
Lighting	£76	£76	£0
Generated (PV)	-£78	-£78	£0
Total cost of fuels	£275	£243	£31
Total cost of uses	£275	£243	£32
Delivered energy	49 kWh/m²	38 kWh/m²	11 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m²	11 kg/m²	9 kg/m²	2 kg/m²
Primary energy	61 kWh/m²	49 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 heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1350 (8)
Pressure test					Yes
Measured/design AP50					3.9500
Infiltration rate					0.3325 (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) =	0.2826 (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	0.3604	0.3533	0.3462	0.3109	0.3038	0.2685	0.2685	0.2615	0.2826	0.3038	0.3180	0.3321 (22b)
Effective ac	0.5649	0.5624	0.5599	0.5483	0.5462	0.5361	0.5361	0.5342	0.5399	0.5462	0.5506	0.5551 (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	52.1000	18.9700	33.1300	0.2500	8.2825	60.0000	1987.8000 (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)			145.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2491		(33)
E-WM-28			84.9900	0.0000	0.0000	110.0000	9348.9000 (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			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19014.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.5399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4993 (36)
Total fabric heat loss						(33) + (36) =	52.7484 (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	41.4197	41.2349	41.0537	40.2025	40.0433	39.3019	39.3019	39.1646	39.5875	40.0433	40.3654	40.7022 (38)
Heat transfer coeff	94.1682	93.9833	93.8021	92.9509	92.7917	92.0503	92.0503	91.9131	92.3359	92.7917	93.1138	93.4506 (39)
Average = Sum(39)m / 12 =												92.9502 (39)
HLP	1.0130	1.0110	1.0091	0.9999	0.9982	0.9902	0.9902	0.9887	0.9933	0.9982	1.0017	1.0053 (40)
HLP (average)												0.9999 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	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												
(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	0.7700	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)												
tau	56.0877	56.1980	56.3066	56.8222	56.9197	57.3781	57.3781	57.4638	57.2007	56.9197	56.7228	56.5183
alpha	4.7392	4.7465	4.7538	4.7881	4.7946	4.8252	4.8252	4.8309	4.8134	4.7946	4.7815	4.7679
util living area	0.9894	0.9834	0.9675	0.9232	0.8249	0.6563	0.4934	0.5376	0.7732	0.9397	0.9818	0.9913 (86)
MIT	19.9025	20.0343	20.2701	20.5747	20.8210	20.9561	20.9909	20.9865	20.9027	20.5905	20.1936	19.8719 (87)
Th 2	20.0725	20.0742	20.0758	20.0834	20.0848	20.0915	20.0915	20.0927	20.0889	20.0848	20.0820	20.0789 (88)
util rest of house	0.9867	0.9791	0.9589	0.9023	0.7792	0.5783	0.3960	0.4383	0.7037	0.9189	0.9763	0.9890 (89)
MIT 2	18.6173	18.8092	19.1492	19.5812	19.9034	20.0591	20.0874	20.0860	20.0072	19.6119	19.0472	18.5776 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	18.8873	19.0666	19.3847	19.7899	20.0962	20.2476	20.2772	20.2752	20.1953	19.8175	19.2880	18.8495 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7373	18.9166	19.2347	19.6399	19.9462	20.0976	20.1272	20.1252	20.0453	19.6675	19.1380	18.6995 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9812	0.9718	0.9487	0.8901	0.7714	0.5788	0.3999	0.4419	0.6999	0.9069	0.9686	0.9842 (94)
Useful gains	664.0283	710.4689	745.2991	747.9412	669.6988	487.8726	322.2560	338.4861	504.5823	607.2739	623.9377	638.7323 (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	1359.5360	1317.3261	1194.5376	998.2860	765.1800	506.0537	324.6808	342.3952	548.9649	841.3888	1120.9066	1354.9859 (97a)
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	517.4577	407.8081	334.2335	180.2482	71.0380	0.0000	0.0000	0.0000	0.0000	174.1815	357.8176	532.8927 (98)
Space heating												2575.6772 (98)
Space heating per m2												27.7074 (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	2861.8636	(211)

[illegible][illegible]

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 * 0.54 * 908 * 1.00) =	-392.1930	-392.1930 (233)
Total delivered energv for all uses		4069.6204 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2861.8636	3.4800	99.5929 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1042.6169	3.4800	36.2831 (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	-392.1930	13.1900	-51.7303 (252)
Total energy cost			277.6579 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	0.8453 (257)
SAP value		88.2082
SAP rating (Section 12)		88 (258)
SAP band		R

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	2861.8636	0.2160	618.1625 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1042.6169	0.2160	225.2053 (264)
Space and water heating			843.3678 (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	-392.1930	0.5190	-203.5482 (269)
Total kg/year			929.0754 (272)
CO2 emissions per m2			9.9900 (273)
EI value			90.9759
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 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					3.9500
Infiltration rate					0.3325 (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) =	0.2826 (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	0.2968	0.2756	0.2826	0.2685	0.2685	0.2615	0.2544	0.2473	0.2403	0.2615	0.2473	0.2615 (22b)
Effective ac	0.5440	0.5380	0.5399	0.5361	0.5361	0.5342	0.5324	0.5306	0.5289	0.5342	0.5306	0.5342 (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	52.1000	18.9700	33.1300	0.2500	8.2825	60.0000	1987.8000 (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)			145.0600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.2491		(33)
E-WM-28			84.9900	0.0000	0.0000	110.0000	9348.9000 (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			46.4800			18.0000	836.6400 (32d)
Internal Ceiling			46.4800			18.0000	836.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19014.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							204.5399 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4993 (36)
Total fabric heat loss						(33) + (36) =	52.7484 (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	39.8877	39.4429	39.5875	39.3019	39.3019	39.1646	39.0310	38.9011	38.7748	39.1646	38.9011	39.1646 (38)
Heat transfer coeff	92.6361	92.1913	92.3359	92.0503	92.0503	91.9131	91.7794	91.6495	91.5232	91.9131	91.6495	91.9131 (39)
Average = Sum(39)m / 12 =												91.9671 (39)
HLP	0.9965	0.9917	0.9933	0.9902	0.9902	0.9887	0.9873	0.9859	0.9845	0.9887	0.9859	0.9887 (40)
HLP (average)												0.9893 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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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	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												-896.7622 (H17)
Solar input	-29.2546	-41.5981	-71.4972	-96.4662	-113.3054	-121.0280	-118.4828	-106.0457	-83.0265	-57.4016	-34.6004	-24.0558 (63)
Solar input (sum of months) = Sum (63)m =												-896.7622 (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												
(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	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)												
tau	57.0153	57.2904	57.2007	57.3781	57.3781	57.4638	57.5475	57.6291	57.7086	57.7885	57.8691	57.9497
alpha	4.8010	4.8194	4.8134	4.8252	4.8252	4.8309	4.8365	4.8419	4.8472	4.8526	4.8580	4.8634
util living area	0.9862	0.9801	0.9588	0.8987	0.7747	0.5688	0.4181	0.4357	0.7004	0.9107	0.9735	0.9882 (86)
MIT	20.0161	20.1209	20.3643	20.6613	20.8799	20.9787	20.9961	20.9953	20.9437	20.6954	20.3246	20.0030 (87)
Th 2	20.0862	20.0902	20.0889	20.0915	20.0915	20.0927	20.0939	20.0951	20.0962	20.0927	20.0951	20.0927 (88)
util rest of house	0.9826	0.9750	0.9478	0.8722	0.7197	0.4862	0.3230	0.3371	0.6209	0.8807	0.9654	0.9851 (89)
MIT 2	18.7920	18.9458	19.2925	19.7037	19.9781	20.0792	20.0925	20.0934	20.0541	19.7585	19.2447	18.7779 (90)
Living area fraction									fLA = Living area / (4) =			0.2101 (91)
MIT	19.0491	19.1927	19.5177	19.9049	20.1676	20.2682	20.2823	20.2829	20.2410	19.9553	19.4716	19.0353 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.8991	19.0427	19.3677	19.7549	20.0176	20.1182	20.1323	20.1329	20.0910	19.8053	19.3216	18.8853 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9762	0.9671	0.9369	0.8606	0.7147	0.4886	0.3271	0.3412	0.6204	0.8691	0.9562	0.9793	(94)
Useful gains	677.8376	717.7209	754.2697	748.1018	631.0918	435.1030	277.4521	276.9395	469.9531	604.1615	636.6286	648.6675	(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	1296.8254	1266.9546	1141.9809	943.9629	691.9962	442.8548	278.3060	277.9618	493.3982	772.5590	1046.7820	1276.2413	(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	460.5269	369.0851	288.4572	141.0200	45.3128	0.0000	0.0000	0.0000	0.0000	125.2878	295.3105	466.9149	(98)
Space heating												2191.9151	(98)
Space heating per m2												(98) / (4) =	23.5791 (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													2435.4613 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	460.5269	369.0851	288.4572	141.0200	45.3128	0.0000	0.0000	0.0000	0.0000	125.2878	295.3105	466.9149	(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)	511.6966	410.0945	320.5080	156.6889	50.3476	0.0000	0.0000	0.0000	0.0000	139.2086	328.1228	518.7943	(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	89.1595	89.1820	89.1673	89.1169	88.7000	86.7000	86.7000	86.7000	86.7000	88.5532	88.9743	89.1675	(217)
Fuel for water heating, kWh/month	170.0308	131.3971	105.1773	55.6986	31.9889	3.9558	0.0000	29.6425	56.9516	106.4004	144.1899	170.1946	(219)
Water heating fuel used												1005.6277	(219)
Annual totals kWh/year													
Space heating fuel - main system												2435.4613	(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 * 0.54 * 1031 * 1.00) =									-445.3995			-445.3995	(233)
Total delivered energy for all uses												3553.0222	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2435.4613	3.9300	95.7136	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1005.6277	3.9300	39.5212	(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	-445.3995	17.5600	-78.2122	(252)
Total energy cost			242.8903	(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	2435.4613	0.2160	526.0596	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1005.6277	0.2160	217.2156	(264)
Space and water heating			743.2752	(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	-445.3995	0.5190	-231.1624	(269)

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Total kg/year 801.3686 (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	2435.4613	1.2200	2971.2627 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1005.6277	1.2200	1226.8658 (264)
Space and water heating			4198.1285 (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	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			4541.7638 (272)
Primary energy kWh/m2/year			48.8572 (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	204.5 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	293.27 (P1)
Transmission heat loss coefficient	52.75 (37)
Summer heat loss coefficient	346.02 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	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	2.81	2.65	2.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 204.5)	0.57	0.57	0.57	
Threshold temperature	18.78	20.52	20.39	(P7)
Likelihood of high internal temperature	Not significant	Slight	Not significant	
Assessment of likelihood of high internal temperature:	Slight			