

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-0015-3817-130				Issued on Date	22/08/2019
Assessment Reference	As Built	Prop Type Ref	SHL2 - Mid (As)			
Property	39, Appleby Drive, Botley, SOUTHAMPTON, SO32 2GE					
SAP Rating	86 B	DER	15.48	TER	18.74	
Environmental	88 B	% DER<TER	17.42			
CO ₂ Emissions (t/year)	0.96	DFEE	46.75	TFEE	51.94	
General Requirements Compliance	Pass	% DFEE<TFEE	10.00			
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 79 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.74 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.48 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.30 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.15 (max. 0.25)	0.15 (max. 0.70)	OK
Roof	0.13 (max. 0.20)	0.13 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.99 (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: 4.68 m², No overhang
Windows facing West: 4.14 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Door U-value 0.90 W/m²K
Photovoltaic array 0.54 kW

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1589 (8)
Pressure test										Yes							
Measured/design AP50										4.9900							
Infiltration rate										0.4084 (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) =					0.3471 (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	0.4426	0.4339	0.4252	0.3818	0.3732	0.3298	0.3298	0.3211	0.3471	0.3732	0.3905	0.4079	(22b)				
Effective ac	0.5979	0.5941	0.5904	0.5729	0.5696	0.5544	0.5544	0.5516	0.5603	0.5696	0.5763	0.5832	(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 Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			8.8200	1.3258	11.6932		(27)
Half Glaze			2.1200	1.4000	2.9680		(26a)
Heat Loss Floor 1			39.5000	0.1500	5.9250	75.0000	2962.5000 (28a)
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.2500	9.2075	60.0000	2209.8000 (29a)
Wall to Unheated Roof			3.8300	0.2900	1.1107	110.0000	421.3000 (29a)
E-WM-28 To Drive Through			15.1300	0.3000	4.5390	110.0000	1664.3000 (29a)
External Roof 1	39.5000		39.5000	0.1300	5.1350	9.0000	355.5000 (30)
Total net area of external elements Aum(A, m ²)			147.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.4954		(33)
Party Wall 1			52.9800	0.0000	0.0000	45.0000	2384.1000 (32)
GF			55.8100			9.0000	502.2900 (32c)
FF			73.3500			9.0000	660.1500 (32c)
GF Block			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			39.5000			18.0000	711.0000 (32d)
Internal Floor 1			39.5000			18.0000	711.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.6575 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7406 (36)
Total fabric heat loss						(33) + (36) =	53.2360 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.2563	37.0193	36.7870	35.6960	35.4919	34.5417	34.5417	34.3657	34.9077	35.4919	35.9048	36.3365 (38)
Heat transfer coeff	90.4923	90.2553	90.0230	88.9320	88.7279	87.7777	87.7777	87.6017	88.1437	88.7279	89.1408	89.5726 (39)
Average = Sum(39)m / 12 =												88.9311 (39)
HLP	1.1455	1.1425	1.1395	1.1257	1.1231	1.1111	1.1111	1.1089	1.1157	1.1231	1.1284	1.1338 (40)
HLP (average)												1.1257 (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												2.4436 (42)
Average daily hot water use (litres/day)												92.2358 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571 (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	21.8118	19.6691	21.7119	20.9384	21.5831	20.8255	21.4815	21.5474	20.8870	21.6586	21.0447	21.7909 (61)
Total heat required for water heating calculated for each month	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (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	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (64)
Heat gains from water heating, kWh/month	55.4813	48.6724	50.5794	44.5987	43.1666	37.7997	35.5729	40.0446	40.2935	46.2874	49.8769	53.8976 (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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8508	19.4077	15.7834	11.9491	8.9321	7.5408	8.1481	10.5912	14.2155	18.0499	21.0669	22.4581 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	74.5717	72.4292	67.9830	61.9426	58.0196	52.4996	47.8130	53.8235	55.9632	62.2142	69.2735	72.4429 (72)
Total internal gains	376.4146	374.0843	360.3305	338.3568	316.1440	294.8785	281.2097	287.4080	298.8552	321.0396	346.3887	365.3036 (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					4.6800	19.6403	0.6200	0.7000	0.7700		27.6450 (76)	
West					4.1400	19.6403	0.6200	0.7000	0.7700		24.4552 (80)	
Solar gains	52.1001	101.9189	167.8459	244.7933	300.0034	307.1068	292.3782	251.1486	195.2118	120.9354	64.9627	42.8446 (83)
Total gains	428.5147	476.0032	528.1765	583.1501	616.1473	601.9853	573.5879	538.5566	494.0670	441.9750	411.3514	408.1482 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.5671	43.6815	43.7942	44.3314	44.4334	44.9144	44.9144	45.0046	44.7279	44.4334	44.2276	44.0144
alpha	3.9045	3.9121	3.9196	3.9554	3.9622	3.9943	3.9943	4.0003	3.9819	3.9622	3.9485	3.9343
util living area	0.9948	0.9914	0.9826	0.9573	0.8960	0.7712	0.6207	0.6711	0.8728	0.9711	0.9914	0.9957 (86)
MIT	19.3395	19.4972	19.7948	20.2038	20.5798	20.8495	20.9534	20.9359	20.7272	20.2406	19.7226	19.3142 (87)
Th 2	19.9639	19.9663	19.9687	19.9799	19.9820	19.9918	19.9918	19.9936	19.9880	19.9820	19.9777	19.9733 (88)
util rest of house	0.9934	0.9892	0.9779	0.9446	0.8621	0.6942	0.5001	0.5541	0.8184	0.9601	0.9888	0.9946 (89)
MIT 2	17.7407	17.9722	18.4063	19.0014	19.5230	19.8667	19.9673	19.9565	19.7292	19.0623	18.3095	17.7100 (90)
Living area fraction	18.0617	18.2784	18.6851	19.2428	19.7352	20.0640	20.1653	20.1532	19.9296	19.2989	18.5932	18.0321 (92)
MIT	18.0617	18.2784	18.6851	19.2428	19.7352	20.0640	20.1653	20.1532	19.9296	19.2989	18.5932	18.0321 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9117	18.1284	18.5351	19.0928	19.5852	19.9140	20.0153	20.0032	19.7796	19.1489	18.4432	17.8821 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9894	0.9833	0.9684	0.9298	0.8458	0.6874	0.5032	0.5553	0.8045	0.9473	0.9828	0.9911 (94)
Ext temp.	423.9615	468.0762	511.4918	542.2159	521.1316	413.8134	288.6289	299.0844	397.4787	418.6789	404.2685	404.5326 (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	1231.7513	1193.9309	1083.4358	906.4631	699.6362	466.4486	299.7828	315.6421	500.6212	758.5243	1011.1448	1225.5369 (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	600.9956	487.7744	425.5263	262.2579	132.8074	0.0000	0.0000	0.0000	0.0000	252.8450	436.9509	610.8272 (98)
Space heating per m2												40.6327 (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													3566.6497 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	600.9956	487.7744	425.5263	262.2579	132.8074	0.0000	0.0000	0.0000	0.0000	252.8450	436.9509	610.8272	(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)	667.7729	541.9715	472.8070	291.3977	147.5638	0.0000	0.0000	0.0000	0.0000	280.9389	485.5010	678.6969	(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	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047	(64)
Efficiency of water heater (217)m	89.2432	89.1964	89.0840	88.8270	88.3046	86.7000	86.7000	86.7000	86.7000	88.7708	89.1109	86.7000	(216)
Fuel for water heating, kWh/month	193.0377	169.5849	176.8057	156.8516	153.0831	137.0825	129.5457	145.0766	145.7507	162.8735	174.1958	187.6409	(219)
Water heating fuel used												1931.5286	(219)
Annual totals kWh/year													
Space heating fuel - main system												3566.6497	(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)												385.8922	(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												5566.8775	(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	3566.6497	0.2160	770.3963	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1931.5286	0.2160	417.2102	(264)
Space and water heating			1187.6065	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	385.8922	0.5190	200.2781	(268)
Energy saving/generation technologies				
PV Unit	-392.1930	0.5190	-203.5482	(269)
Total CO2, kg/year			1223.2614	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4800	(273)

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

DER			15.4800	ZC1
Total Floor Area		TFA	79.0000	
Assumed number of occupants		N	2.4436	
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO2 emissions from appliances, equation (L14)			16.3025	ZC2
CO2 emissions from cooking, equation (L16)			2.2487	ZC3
Total CO2 emissions			34.0312	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			34.0312	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (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) = 0.1589 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4089 (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) =	0.3476 (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	0.4431	0.4344	0.4258	0.3823	0.3736	0.3302	0.3302	0.3215	0.3476	0.3736	0.3910	0.4084 (22b)
Effective ac	0.5982	0.5944	0.5906	0.5731	0.5698	0.5545	0.5545	0.5517	0.5604	0.5698	0.5764	0.5834 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			8.8200	1.3258	11.6932		(27)
Heat Loss Floor 1			39.5000	0.1300	5.1350		(28a)
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.1800	6.6294		(29a)
Wall to Unheated Roof			3.8300	0.1800	0.6894		(29a)
E-WM-28 To Drive Through			15.1300	0.1800	2.7234		(29a)
External Roof 1	39.5000		39.5000	0.1300	5.1350		(30)
Total net area of external elements Aum(A, m ²)			147.8600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.6794	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2153 (36)
Total fabric heat loss						(33) + (36) =	49.8947 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.2712	37.0337	36.8008	35.7071	35.5025	34.5500	34.5500	34.3736	34.9169	35.5025	35.9165	36.3492 (38)
Heat transfer coeff	87.1659	86.9284	86.6955	85.6018	85.3972	84.4446	84.4446	84.2682	84.8116	85.3972	85.8112	86.2439 (39)
Average = Sum(39)m / 12 =												85.6008 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1034	1.1004	1.0974	1.0836	1.0810	1.0689	1.0689	1.0667	1.0736	1.0810	1.0862	1.0917 (40)
HLP (average)												1.0836 (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												2.4436 (42)
Average daily hot water use (litres/day)												92.2358 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)												Total = Sum(45)m = 1451.2285 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571 (46)
Water storage loss:												

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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	50.9589	45.0010	47.9424	44.5764	44.1822	40.9375	42.3021	44.1822	44.5764	47.9424	48.2153	50.9589 (61)
Total heat required for water heating calculated for each month	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727 (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	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727 (64)
Heat gains from water heating, kWh/month	62.7681	55.0054	57.1370	50.5082	48.8163	42.8277	40.7780	45.7034	46.2158	52.8583	56.6696	61.1896 (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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8508	19.4077	15.7834	11.9491	8.9321	7.5408	8.1481	10.5912	14.2155	18.0499	21.0669	22.4581	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	84.3658	81.8533	76.7970	70.1503	65.6133	59.4829	54.8092	61.4292	64.1887	71.0461	78.7078	82.2440	(72)
Total internal gains	386.2086	383.5083	369.1445	346.5644	323.7378	301.8618	288.2059	295.0138	307.0807	329.8715	355.8229	375.1047	(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					4.6800	19.6403	0.6300	0.7000	0.7700			28.0909 (76)
West					4.1400	19.6403	0.6300	0.7000	0.7700			24.8496 (80)

Solar gains	52.9405	103.5628	170.5531	248.7416	304.8421	312.0602	297.0940	255.1994	198.3604	122.8860	66.0105	43.5357 (83)
Total gains	439.1491	487.0711	539.6977	595.3060	628.5799	613.9220	585.2999	550.2131	505.4411	452.7575	421.8335	418.6403 (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	62.9387	63.1107	63.2802	64.0887	64.2423	64.9670	64.9670	65.1030	64.6859	64.2423	63.9324	63.6116	
alpha	5.1959	5.2074	5.2187	5.2726	5.2828	5.3311	5.3311	5.3402	5.3124	5.2828	5.2622	5.2408	
util living area	0.9986	0.9973	0.9930	0.9763	0.9213	0.7839	0.6130	0.6685	0.8963	0.9858	0.9973	0.9989	(86)
MIT	19.7805	19.9038	20.1344	20.4530	20.7410	20.9286	20.9846	20.9761	20.8406	20.4681	20.0713	19.7615	(87)
Th 2	19.9981	20.0005	20.0029	20.0143	20.0164	20.0263	20.0263	20.0281	20.0225	20.0164	20.0121	20.0076	(88)
util rest of house	0.9981	0.9964	0.9904	0.9666	0.8874	0.6992	0.4884	0.5447	0.8389	0.9784	0.9961	0.9986	(89)
MIT 2	18.3649	18.5468	18.8847	19.3517	19.7477	19.9751	20.0202	20.0175	19.8843	19.3796	18.8004	18.3441	(90)
Living area fraction									fLA = Living area / (4) =			0.2008	(91)
MIT	18.6491	18.8192	19.1356	19.5728	19.9471	20.1665	20.2138	20.2099	20.0763	19.5981	19.0556	18.6286	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6491	18.8192	19.1356	19.5728	19.9471	20.1665	20.2138	20.2099	20.0763	19.5981	19.0556	18.6286	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9972	0.9948	0.9872	0.9609	0.8845	0.7127	0.5135	0.5694	0.8428	0.9739	0.9945	0.9978	(94)
Useful gains	437.9086	484.5151	532.8055	572.0439	556.0033	437.5273	300.5556	313.2681	425.9643	440.9595	419.5121	417.7183	(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	1250.7519	1209.9770	1095.4463	913.6077	704.2802	470.0611	305.1660	321.0547	506.8585	768.4117	1025.9232	1244.3824	(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	604.7554	487.5104	418.6048	245.9259	110.3180	0.0000	0.0000	0.0000	0.0000	243.6245	436.6160	615.0381	(98)
Space heating												3162.3930	(98)
Space heating per m2												(98) / (4) =	40.0303 (99)

8c. Space cooling requirement

Not applicable

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3385.8598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	604.7554	487.5104	418.6048	245.9259	110.3180	0.0000	0.0000	0.0000	0.0000	243.6245	436.6160	615.0381	(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)	647.4897	521.9597	448.1850	263.3040	118.1135	0.0000	0.0000	0.0000	0.0000	260.8399	467.4689	658.4990	(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	201.4203	176.5954	183.7361	162.9647	157.7785	138.9625	133.1367	148.4162	150.0553	170.8679	182.3981	196.6727	(64)
Efficiency of water heater (217)m	87.6457	87.4743	87.0598	86.0846	84.1696	80.3000	80.3000	80.3000	80.3000	85.9438	87.1694	80.3000	(216)
Fuel for water heating, kWh/month	229.8119	201.8826	211.0459	189.3075	187.4532	173.0542	165.7991	184.8272	186.8684	198.8135	209.2456	224.1884	(219)
Water heating fuel used												2362.2975	(219)
Annual totals kWh/year													
Space heating fuel - main system												3385.8598	(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)												385.8922	(232)
Total delivered energy for all uses												6209.0495	(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	3385.8598	0.2160	731.3457 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2362.2975	0.2160	510.2563 (264)
Space and water heating			1241.6020 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	385.8922	0.5190	200.2781 (268)
Total CO2, kg/m2/year			1480.8050 (272)
Emissions per m2 for space and water heating			15.7165 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5352 (272b)
Emissions per m2 for pumps and fans			0.4927 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7165 * 1.00) + 2.5352 + 0.4927, rounded to 2 d.p.			18.7400 (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	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1589 (8)
Pressure test										Yes							
Measured/design AP50										4.9900							
Infiltration rate										0.4084 (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) =					0.3471 (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	0.4426	0.4339	0.4252	0.3818	0.3732	0.3298	0.3298	0.3211	0.3471	0.3732	0.3905	0.4079	(22b)				
Effective ac	0.5979	0.5941	0.5904	0.5729	0.5696	0.5544	0.5544	0.5516	0.5603	0.5696	0.5763	0.5832	(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						
Solid Door			2.1300	0.9000	1.9170			(26)					
Window (Uw = 1.40)			8.8200	1.3258	11.6932			(27)					
Half Glaze			2.1200	1.4000	2.9680			(26a)					
Heat Loss Floor 1			39.5000	0.1500	5.9250	75.0000	2962.5000	(28a)					
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.2500	9.2075	60.0000	2209.8000	(29a)					
Wall to Unheated Roof	3.8300		3.8300	0.2900	1.1107	110.0000	421.3000	(29a)					
E-WM-28 To Drive Through	15.1300		15.1300	0.3000	4.5390	110.0000	1664.3000	(29a)					
External Roof 1	39.5000		39.5000	0.1300	5.1350	9.0000	355.5000	(30)					
Total net area of external elements Aum(A, m2)			147.8600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.4954			(33)					
Party Wall 1			52.9800	0.0000	0.0000	45.0000	2384.1000	(32)					
GF			55.8100			9.0000	502.2900	(32c)					
FF			73.3500			9.0000	660.1500	(32c)					
GF Block			21.4800			75.0000	1611.0000	(32c)					
Internal Floor 1			39.5000			18.0000	711.0000	(32d)					
Internal Floor 1			39.5000			9.0000	355.5000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	13837.4400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							175.1575	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7406	(36)					
Total fabric heat loss						(33) + (36) =	53.2360	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 37.2563	Feb 37.0193	Mar 36.7870	Apr 35.6960	May 35.4919	Jun 34.5417	Jul 34.5417	Aug 34.3657	Sep 34.9077	Oct 35.4919	Nov 35.9048	Dec 36.3365	(38)
Heat transfer coeff	90.4923	90.2553	90.0230	88.9320	88.7279	87.7777	87.7777	87.6017	88.1437	88.7279	89.1408	89.5726	(39)
Average = Sum(39)m / 12 =												88.9311	(39)
HLP	Jan 1.1455	Feb 1.1425	Mar 1.1395	Apr 1.1257	May 1.1231	Jun 1.1111	Jul 1.1111	Aug 1.1089	Sep 1.1157	Oct 1.1231	Nov 1.1284	Dec 1.1338	(40)
HLP (average)												1.1257	(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											
2.4436 (42)											
Average daily hot water use (litres/day)											
92.2358 (43)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.9730	27.9638	28.8562	25.1575	24.1392	20.8303	19.3023	22.1497	22.4143	26.1217	28.5138	30.9642 (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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8508	19.4077	15.7834	11.9491	8.9321	7.5408	8.1481	10.5912	14.2155	18.0499	21.0669	22.4581 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	42.9745	41.6128	38.7852	34.9410	32.4452	28.9310	25.9440	29.7711	31.1309	35.1098	39.6025	41.6185 (72)
Total internal gains	341.8174	340.2679	328.1326	308.3551	287.5696	268.3099	256.3407	260.3557	271.0230	290.9351	313.7177	331.4792 (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				4.6800	19.6403	0.6200		0.7000	0.7700	27.6450 (76)					
West				4.1400	19.6403	0.6200		0.7000	0.7700	24.4552 (80)					
Solar gains				52.1001	101.9189	167.8459	244.7933	300.0034	307.1068	292.3782	251.1486	195.2118	120.9354	64.9627	42.8446 (83)
Total gains				393.9175	442.1868	495.9786	553.1484	587.5730	575.4167	548.7189	511.5042	466.2348	411.8705	378.6804	374.3238 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.4758	42.5873	42.6972	43.2210	43.3205	43.7894	43.7894	43.8774	43.6076	43.3205	43.1198	42.9120
alpha	3.8317	3.8392	3.8465	3.8814	3.8880	3.9193	3.9193	3.9252	3.9072	3.8880	3.8747	3.8608
util living area	0.9957	0.9928	0.9849	0.9618	0.9051	0.7871	0.6399	0.6930	0.8866	0.9755	0.9929	0.9965 (86)
MIT	19.2554	19.4178	19.7246	20.1478	20.5401	20.8288	20.9448	20.9237	20.6941	20.1834	19.6489	19.2305 (87)
Th 2	19.9639	19.9663	19.9687	19.9799	19.9820	19.9918	19.9918	19.9936	19.9880	19.9820	19.9777	19.9733 (88)
util rest of house	0.9946	0.9909	0.9808	0.9504	0.8737	0.7126	0.5188	0.5767	0.8365	0.9662	0.9908	0.9956 (89)
MIT 2	18.3648	18.5284	18.8351	19.2599	19.6348	19.8924	19.9713	19.9624	19.7855	19.3009	18.7681	18.3471 (90)
Living area fraction												
MIT	18.5436	18.7069	19.0137	19.4381	19.8165	20.0804	20.1667	20.1554	19.9679	19.4781	18.9449	18.5244 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5436	18.7069	19.0137	19.4381	19.8165	20.0804	20.1667	20.1554	19.9679	19.4781	18.9449	18.5244 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9926	0.9878	0.9757	0.9427	0.8675	0.7200	0.5416	0.5974	0.8353	0.9600	0.9879	0.9939 (94)
Useful gains	390.9950	436.8080	483.9212	521.4477	509.7463	414.3002	297.1623	305.5523	389.4563	395.3846	374.0801	372.0383 (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	1288.9364	1246.1479	1126.5202	937.1756	720.1644	481.0533	313.0775	328.9785	517.2180	787.7328	1055.8650	1283.0771 (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	668.0684	543.8764	478.0937	299.3241	156.5511	0.0000	0.0000	0.0000	0.0000	291.9070	490.8851	677.8129 (98)
Space heating												3606.5188 (98)
Space heating per m2										(98) / (4) =		45.6521 (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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	825.1101	649.5547	665.7729	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7654	0.8412	0.8110	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	631.5185	546.4175	539.9414	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	764.7075	731.7108	690.0891	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	95.8961	137.8583	111.7099	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												345.4642	(104)
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	23.9740	34.4646	27.9275	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												86.3661	(107)
Space cooling per m2												1.0932	(108)
Energy for space heating												45.6521	(99)
Energy for space cooling												1.0932	(108)
Total												46.7454	(109)
Dwelling Fabric Energy Efficiency (DFEE)												46.7	(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	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (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) = 0.1589 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4089 (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) =	0.3476 (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	0.4431	0.4344	0.4258	0.3823	0.3736	0.3302	0.3302	0.3215	0.3476	0.3736	0.3910	0.4084 (22b)
Effective ac	0.5982	0.5944	0.5906	0.5731	0.5698	0.5545	0.5545	0.5517	0.5604	0.5698	0.5764	0.5834 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1300	1.0000	2.1300		(26)
TER Semi-glazed door			2.1200	1.2000	2.5440		(26a)
TER Opening Type (Uw = 1.40)			8.8200	1.3258	11.6932		(27)
Heat Loss Floor 1			39.5000	0.1300	5.1350		(28a)
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.1800	6.6294		(29a)
Wall to Unheated Roof			3.8300	0.1800	0.6894		(29a)
E-WM-28 To Drive Through			15.1300	0.1800	2.7234		(29a)
External Roof 1	39.5000		39.5000	0.1300	5.1350		(30)
Total net area of external elements Aum(A, m ²)			147.8600				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	36.6794	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							13.2153 (36)
Total fabric heat loss						(33) + (36) =	49.8947 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.2712	37.0337	36.8008	35.7071	35.5025	34.5500	34.5500	34.3736	34.9169	35.5025	35.9165	36.3492 (38)
Heat transfer coeff	87.1659	86.9284	86.6955	85.6018	85.3972	84.4446	84.4446	84.2682	84.8116	85.3972	85.8112	86.2439 (39)
Average = Sum(39)m / 12 =												85.6008 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1034	1.1004	1.0974	1.0836	1.0810	1.0689	1.0689	1.0667	1.0736	1.0810	1.0862	1.0917 (40)
HLP (average)												1.0836 (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												2.4436 (42)
Average daily hot water use (litres/day)												92.2358 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)												Total = Sum(45)m = 1451.2285 (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:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.9730	27.9638	28.8562	25.1575	24.1392	20.8303	19.3023	22.1497	22.4143	26.1217	28.5138	30.9642 (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	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	122.1807	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.8508	19.4077	15.7834	11.9491	8.9321	7.5408	8.1481	10.5912	14.2155	18.0499	21.0669	22.4581	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	217.3379	219.5931	213.9099	201.8109	186.5382	172.1839	162.5944	160.3391	166.0223	178.1213	193.3941	207.7483	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	35.2181	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	42.9745	41.6128	38.7852	34.9410	32.4452	28.9310	25.9440	29.7711	31.1309	35.1098	39.6025	41.6185	(72)
Total internal gains	341.8174	340.2679	328.1326	308.3551	287.5696	268.3099	256.3407	260.3557	271.0230	290.9351	313.7177	331.4792	(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				4.6800	19.6403	0.6300	0.7000	0.7700	28.0909 (76)			
West				4.1400	19.6403	0.6300	0.7000	0.7700	24.8496 (80)			
Solar gains	52.9405	103.5628	170.5531	248.7416	304.8421	312.0602	297.0940	255.1994	198.3604	122.8860	66.0105	43.5357 (83)
Total gains	394.7578	443.8306	498.6858	557.0967	592.4117	580.3701	553.4347	515.5550	469.3833	413.8211	379.7282	375.0148 (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	62.9387	63.1107	63.2802	64.0887	64.2423	64.9670	64.9670	65.1030	64.6859	64.2423	63.9324	63.6116	
alpha	5.1959	5.2074	5.2187	5.2726	5.2828	5.3311	5.3311	5.3402	5.3124	5.2828	5.2622	5.2408	
util living area	0.9992	0.9983	0.9951	0.9821	0.9358	0.8106	0.6427	0.7032	0.9184	0.9905	0.9983	0.9994	(86)
MIT	19.7276	19.8525	20.0868	20.4119	20.7113	20.9155	20.9809	20.9697	20.8142	20.4242	20.0213	19.7094	(87)
Th 2	19.9981	20.0005	20.0029	20.0143	20.0164	20.0263	20.0263	20.0281	20.0225	20.0164	20.0121	20.0076	(88)
util rest of house	0.9989	0.9977	0.9933	0.9745	0.9064	0.7288	0.5148	0.5776	0.8687	0.9853	0.9977	0.9992	(89)
MIT 2	18.8302	18.9570	19.1924	19.5227	19.8078	19.9838	20.0210	20.0186	19.9085	19.5391	19.1351	18.8197	(90)
Living area fraction									fLA = Living area / (4) =			0.2008	(91)
MIT	19.0104	19.1368	19.3719	19.7012	19.9892	20.1708	20.2137	20.2095	20.0903	19.7168	19.3130	18.9983	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0104	19.1368	19.3719	19.7012	19.9892	20.1708	20.2137	20.2095	20.0903	19.7168	19.3130	18.9983	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9969	0.9917	0.9713	0.9054	0.7424	0.5408	0.6030	0.8729	0.9831	0.9969	0.9988	(94)
Ext temp.	394.1575	442.4631	494.5363	541.1147	536.3902	430.8766	299.2909	310.8667	409.7309	406.8103	378.5674	374.5827	(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	1282.2446	1237.5802	1115.9387	924.6013	707.8764	470.4253	305.1548	321.0211	508.0473	778.5512	1048.0115	1276.2669	(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	660.7368	534.3187	462.3234	276.1104	127.5857	0.0000	0.0000	0.0000	0.0000	276.5752	481.9998	670.8531	(98)
Space heating per m2												3490.5030	(98)
												44.1836	(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	793.7796	624.8903	640.4386	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8293	0.9027	0.8745	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	658.2435	564.1050	560.0565	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	770.4971	737.2228	694.8238	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													

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Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	80.8226	128.7996	100.2669	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												309.8891 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	20.2057	32.1999	25.0667	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												77.4723 (107)
Energy for space heating												0.9807 (108)
Energy for space cooling												44.1836 (99)
Total												0.9807 (108)
Target Fabric Energy Efficiency (TFEE)												45.1642 (109)
												51.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour										
										heating	heating													
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)							
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)							
Number of intermittent fans																3 * 10 =	30.0000 (7a)							
Number of passive vents																0 * 10 =	0.0000 (7b)							
Number of flueless gas fires																0 * 40 =	0.0000 (7c)							
										Air changes per hour														
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1589 (8)							
Pressure test										Yes														
Measured/design AP50										4.9900														
Infiltration rate										0.4084 (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) =					0.3471 (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													0.3645	0.3385	0.3471	0.3298	0.3298	0.3211	0.3124	0.3037	0.2951	0.3211	0.3037	0.3211 (22b)
Effective ac													0.5664	0.5573	0.5603	0.5544	0.5544	0.5516	0.5488	0.5461	0.5435	0.5516	0.5461	0.5516 (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 Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			8.8200	1.3258	11.6932		(27)
Half Glaze			2.1200	1.4000	2.9680		(26a)
Heat Loss Floor 1			39.5000	0.1500	5.9250	75.0000	2962.5000 (28a)
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.2500	9.2075	60.0000	2209.8000 (29a)
Wall to Unheated Roof			3.8300	0.2900	1.1107	110.0000	421.3000 (29a)
E-WM-28 To Drive Through			15.1300	0.3000	4.5390	110.0000	1664.3000 (29a)
External Roof 1	39.5000		39.5000	0.1300	5.1350	9.0000	355.5000 (30)
Total net area of external elements Aum(A, m ²)			147.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.4954		(33)
Party Wall 1			52.9800	0.0000	0.0000	45.0000	2384.1000 (32)
GF			55.8100			9.0000	502.2900 (32c)
FF			73.3500			9.0000	660.1500 (32c)
GF Block			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			39.5000			18.0000	711.0000 (32d)
Internal Floor 1			39.5000			18.0000	711.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.6575 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7406 (36)
Total fabric heat loss						(33) + (36) =	53.2360 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.2925	34.7223	34.9077	34.5417	34.5417	34.3657	34.1944	34.0278	33.8659	34.3657	34.0278	34.3657 (38)
Heat transfer coeff	88.5285	87.9583	88.1437	87.7777	87.7777	87.6017	87.4304	87.2638	87.1019	87.6017	87.2638	87.6017 (39)
Average = Sum(39)m / 12 =												87.6709 (39)
HLP	1.1206	1.1134	1.1157	1.1111	1.1111	1.1089	1.1067	1.1046	1.1026	1.1089	1.1046	1.1089 (40)
HLP (average)												1.1098 (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												2.4436 (42)
Average daily hot water use (litres/day)												92.2358 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)										Total =	Sum (45)m =	1451.2285 (45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571 (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	21.8118	19.6691	21.7119	20.9384	21.5831	20.8255	21.4815	21.5474	20.8870	21.6586	21.0447	21.7909 (61)
Total heat required for water heating calculated for each month	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (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	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (64)
RHI water heating demand												1706 (64)
Heat gains from water heating, kWh/month	55.4813	48.6724	50.5794	44.5987	43.1666	37.7997	35.5729	40.0446	40.2935	46.2874	49.8769	53.8976 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.6270	48.5192	39.4585	29.8726	22.3301	18.8520	20.3703	26.4781	35.5388	45.1247	52.6672	56.1453 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	74.5717	72.4292	67.9830	61.9426	58.0196	52.4996	47.8130	53.8235	55.9632	62.2142	69.2735	72.4429 (72)
Total internal gains	557.5611	552.6770	530.6876	497.0031	462.7424	432.3201	414.8390	423.5912	443.2741	477.1692	514.5662	542.6379 (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					4.6800	25.1925	0.6200	0.7000			0.7700	35.4602 (76)
West					4.1400	25.1925	0.6200	0.7000			0.7700	31.3686 (80)

Solar gains	66.8288	111.2028	184.1133	269.0154	312.3635	346.9310	327.8648	289.2774	225.7864	142.2530	83.0539	54.0200 (83)
Total gains	624.3899	663.8798	714.8009	766.0186	775.1059	779.2510	742.7038	712.8686	669.0605	619.4221	597.6200	596.6579 (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	44.5335	44.8222	44.7279	44.9144	44.9144	45.0046	45.0928	45.1789	45.2629	45.0046	45.1789	45.0046
alpha	3.9689	3.9881	3.9819	3.9943	3.9943	4.0003	4.0062	4.0119	4.0175	4.0003	4.0119	4.0003
util living area	0.9784	0.9713	0.9488	0.8929	0.7842	0.5973	0.4479	0.4642	0.7146	0.9010	0.9632	0.9809 (86)
MIT	19.7462	19.8648	20.1433	20.4978	20.7867	20.9477	20.9871	20.9855	20.8908	20.5633	20.1230	19.7397 (87)
Th 2	19.9840	19.9899	19.9880	19.9918	19.9918	19.9936	19.9954	19.9971	19.9987	19.9936	19.9971	19.9936 (88)
util rest of house	0.9733	0.9646	0.9363	0.8660	0.7293	0.5075	0.3378	0.3510	0.6328	0.8696	0.9530	0.9763 (89)
MIT 2	18.3434	18.5179	18.9146	19.4097	19.7832	19.9581	19.9903	19.9913	19.9124	19.5094	18.8969	18.3409 (90)
Living area fraction									fLA = Living area / (4) =			0.2008 (91)
MIT	18.6250	18.7883	19.1612	19.6281	19.9846	20.1568	20.1904	20.1909	20.1088	19.7210	19.1430	18.6217 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4750	18.6383	19.0112	19.4781	19.8346	20.0068	20.0404	20.0409	19.9588	19.5710	18.9930	18.4717 (93)

8. Space heating requirement

Utilisation	0.9628	0.9524	0.9208	0.8495	0.7197	0.5088	0.3429	0.3562	0.6292	0.8533	0.9393	0.9666 (94)
Useful gains	601.1847	632.2834	658.2122	650.7277	557.8146	396.4472	254.6714	253.8901	420.9916	528.5690	561.3592	576.7294 (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	1201.7755	1173.2117	1058.7155	875.8563	643.8162	412.3210	257.0806	256.6317	458.0557	715.7909	968.0206	1180.1450 (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	446.8396	363.5038	297.9745	162.0926	63.9852	0.0000	0.0000	0.0000	0.0000	139.2931	292.7962	448.9412 (98)
Space heating												2215.4261 (98)
RHI space heating demand												2215 (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	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour
										heating	heating			
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)		
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)		
Number of intermittent fans											3 * 10 =	30.0000 (7a)		
Number of passive vents											0 * 10 =	0.0000 (7b)		
Number of flueless gas fires											0 * 40 =	0.0000 (7c)		
												Air changes per hour		
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000	/ (5) =	0.1589 (8)	
Pressure test												Yes		
Measured/design AP50												4.9900		
Infiltration rate												0.4084 (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) =	0.3471 (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	0.4426	0.4339	0.4252	0.3818	0.3732	0.3298	0.3298	0.3211	0.3471	0.3732	0.3905	0.4079 (22b)		
Effective ac	0.5979	0.5941	0.5904	0.5729	0.5696	0.5544	0.5544	0.5516	0.5603	0.5696	0.5763	0.5832 (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						
Solid Door			2.1300	0.9000	1.9170			(26)					
Window (Uw = 1.40)			8.8200	1.3258	11.6932			(27)					
Half Glaze			2.1200	1.4000	2.9680			(26a)					
Heat Loss Floor 1			39.5000	0.1500	5.9250	75.0000	2962.5000	(28a)					
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.2500	9.2075	60.0000	2209.8000	(29a)					
Wall to Unheated Roof			3.8300	0.2900	1.1107	110.0000	421.3000	(29a)					
E-WM-28 To Drive Through	15.1300		15.1300	0.3000	4.5390	110.0000	1664.3000	(29a)					
External Roof 1	39.5000		39.5000	0.1300	5.1350	9.0000	355.5000	(30)					
Total net area of external elements Aum(A, m2)			147.8600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.4954			(33)					
Party Wall 1			52.9800	0.0000	0.0000	45.0000	2384.1000	(32)					
GF			55.8100			9.0000	502.2900	(32c)					
FF			73.3500			9.0000	660.1500	(32c)					
GF Block			21.4800			75.0000	1611.0000	(32c)					
Internal Floor 1			39.5000			18.0000	711.0000	(32d)					
Internal Floor 1			39.5000			18.0000	711.0000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14192.9400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							179.6575	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7406	(36)					
Total fabric heat loss						(33) + (36) =	53.2360	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 37.2563	Feb 37.0193	Mar 36.7870	Apr 35.6960	May 35.4919	Jun 34.5417	Jul 34.5417	Aug 34.3657	Sep 34.9077	Oct 35.4919	Nov 35.9048	Dec 36.3365	(38)
Heat transfer coeff	90.4923	90.2553	90.0230	88.9320	88.7279	87.7777	87.7777	87.6017	88.1437	88.7279	89.1408	89.5726	(39)
Average = Sum(39)m / 12 =												88.9311	(39)
HLP	Jan 1.1455	Feb 1.1425	Mar 1.1395	Apr 1.1257	May 1.1231	Jun 1.1111	Jul 1.1111	Aug 1.1089	Sep 1.1157	Oct 1.1231	Nov 1.1284	Dec 1.1338	(40)
HLP (average)												1.1257	(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											
2.4436 (42)											
Average daily hot water use (litres/day)											
92.2358 (43)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)										Total = Sum (45)m =		1451.2285 (45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571 (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	21.8118	19.6691	21.7119	20.9384	21.5831	20.8255	21.4815	21.5474	20.8870	21.6586	21.0447	21.7909 (61)
Total heat required for water heating calculated for each month	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (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	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (64)
Heat gains from water heating, kWh/month	55.4813	48.6724	50.5794	44.5987	43.1666	37.7997	35.5729	40.0446	40.2935	46.2874	49.8769	53.8976 (65)
Total per year (kWh/year) = Sum (64)m =												
1706.1784 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.6270	48.5192	39.4585	29.8726	22.3301	18.8520	20.3703	26.4781	35.5388	45.1247	52.6672	56.1453 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	74.5717	72.4292	67.9830	61.9426	58.0196	52.4996	47.8130	53.8235	55.9632	62.2142	69.2735	72.4429 (72)
Total internal gains	557.5611	552.6770	530.6876	497.0031	462.7424	432.3201	414.8390	423.5912	443.2741	477.1692	514.5662	542.6379 (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				4.6800	19.6403	0.6200	0.7000	0.7700		27.6450 (76)		
West				4.1400	19.6403	0.6200	0.7000	0.7700		24.4552 (80)		
Solar gains	52.1001	101.9189	167.8459	244.7933	300.0034	307.1068	292.3782	251.1486	195.2118	120.9354	64.9627	42.8446 (83)
Total gains	609.6613	654.5959	698.5335	741.7964	762.7458	739.4269	707.2173	674.7398	638.4859	598.1045	579.5289	585.4826 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.5671	43.6815	43.7942	44.3314	44.4334	44.9144	44.9144	45.0046	44.7279	44.4334	44.2276	44.0144
alpha	3.9045	3.9121	3.9196	3.9554	3.9622	3.9943	3.9943	4.0003	3.9819	3.9622	3.9485	3.9343
util living area	0.9826	0.9752	0.9580	0.9153	0.8286	0.6781	0.5229	0.5641	0.7794	0.9286	0.9729	0.9850 (86)
MIT	19.6039	19.7522	20.0250	20.3893	20.7028	20.9069	20.9746	20.9655	20.8296	20.4347	19.9624	19.5756 (87)
Th 2	19.9639	19.9663	19.9687	19.9799	19.9820	19.9918	19.9918	19.9936	19.9880	19.9820	19.9777	19.9733 (88)
util rest of house	0.9785	0.9695	0.9477	0.8935	0.7833	0.5966	0.4132	0.4545	0.7093	0.9058	0.9655	0.9815 (89)
MIT 2	18.1237	18.3395	18.7330	19.2535	19.6724	19.9192	19.9793	19.9752	19.8388	19.3269	18.6535	18.0891 (90)
Living area fraction	18.4209	18.6231	18.9924	19.4815	19.8793	20.1175	20.1791	20.1740	20.0377	19.5493	18.9162	18.3876 (92)
MIT	18.4209	18.6231	18.9924	19.4815	19.8793	20.1175	20.1791	20.1740	20.0377	19.5493	18.9162	18.3876 (92)
Temperature adjustment	18.2709	18.4731	18.8424	19.3315	19.7293	19.9675	20.0291	20.0240	19.8877	19.3993	18.7662	-0.1500
adjusted MIT	18.2709	18.4731	18.8424	19.3315	19.7293	19.9675	20.0291	20.0240	19.8877	19.3993	18.7662	18.2376 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9691	0.9580	0.9330	0.8765	0.7704	0.5945	0.4174	0.4580	0.7014	0.8890	0.9534	0.9730 (94)
Ext temp.	590.8328	627.0717	651.6986	650.1678	587.5848	439.5707	295.2187	309.0388	447.8023	531.7435	552.5326	569.6532 (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	1264.2556	1225.0441	1111.0968	927.6962	712.4233	471.1442	301.0008	317.4693	510.1477	780.7445	1039.9377	1257.3801 (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	501.0265	401.8374	341.7922	199.8204	92.8798	0.0000	0.0000	0.0000	0.0000	185.2568	350.9317	511.6688 (98)
Space heating per m2												2585.2138 (98)
(98) / (4) =												
32.7242 (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													2872.4598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	501.0265	401.8374	341.7922	199.8204	92.8798	0.0000	0.0000	0.0000	0.0000	185.2568	350.9317	511.6688	(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)	556.6961	446.4860	379.7692	222.0227	103.1998	0.0000	0.0000	0.0000	0.0000	205.8409	389.9241	568.5209	(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	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047	(64)
Efficiency of water heater (217)m	89.1320	89.0728	88.9322	88.6144	88.0143	86.7000	86.7000	86.7000	86.7000	88.5230	88.9616	89.1630	(216)
Fuel for water heating, kWh/month	193.2787	169.8201	177.1075	157.2280	153.5880	137.0825	129.5457	145.0766	145.7507	163.3293	174.4883	187.8634	(219)
Water heating fuel used												1934.1588	(219)
Annual totals kWh/year													
Space heating fuel - main system												2872.4598	(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)												385.8922	(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												4875.3177	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2872.4598	3.4800	99.9616 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1934.1588	3.4800	67.3087 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	385.8922	13.1900	50.8992 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-392.1930	13.1900	-51.7303 (252)
Total energy cost			296.3317 (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] =	1.0037 (257)
SAP value		85.9983
SAP rating (Section 12)		86 (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	2872.4598	0.2160	620.4513 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1934.1588	0.2160	417.7783 (264)
Space and water heating			1038.2296 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	385.8922	0.5190	200.2781 (268)
Energy saving/generation technologies			
PV Unit	-392.1930	0.5190	-203.5482 (269)
Total kg/year			1073.8845 (272)
CO2 emissions per m2			13.5900 (273)
EI value			88.3951
EI rating			88 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9000 = 3.867$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9000 = 0.2400$, stars = 4
Water heating energy efficiency	$3.48 / 0.8810 = 3.950$, stars = 4
Water heating environmental impact	$0.216 / 0.8810 = 0.2452$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour										
										heating	heating													
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)							
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)							
Number of intermittent fans																3 * 10 =	30.0000 (7a)							
Number of passive vents																0 * 10 =	0.0000 (7b)							
Number of flueless gas fires																0 * 40 =	0.0000 (7c)							
										Air changes per hour														
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1589 (8)							
Pressure test										Yes														
Measured/design AP50										4.9900														
Infiltration rate										0.4084 (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) =					0.3471 (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													0.3645	0.3385	0.3471	0.3298	0.3298	0.3211	0.3124	0.3037	0.2951	0.3211	0.3037	0.3211 (22b)
Effective ac													0.5664	0.5573	0.5603	0.5544	0.5544	0.5516	0.5488	0.5461	0.5435	0.5516	0.5461	0.5516 (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 Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			8.8200	1.3258	11.6932		(27)
Half Glaze			2.1200	1.4000	2.9680		(26a)
Heat Loss Floor 1			39.5000	0.1500	5.9250	75.0000	2962.5000 (28a)
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.2500	9.2075	60.0000	2209.8000 (29a)
Wall to Unheated Roof			3.8300	0.2900	1.1107	110.0000	421.3000 (29a)
E-WM-28 To Drive Through			15.1300	0.3000	4.5390	110.0000	1664.3000 (29a)
External Roof 1	39.5000		39.5000	0.1300	5.1350	9.0000	355.5000 (30)
Total net area of external elements Aum(A, m ²)			147.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.4954		(33)
Party Wall 1			52.9800	0.0000	0.0000	45.0000	2384.1000 (32)
GF			55.8100			9.0000	502.2900 (32c)
FF			73.3500			9.0000	660.1500 (32c)
GF Block			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			39.5000			18.0000	711.0000 (32d)
Internal Floor 1			39.5000			18.0000	711.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.6575 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7406 (36)
Total fabric heat loss						(33) + (36) =	53.2360 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.2925	34.7223	34.9077	34.5417	34.5417	34.3657	34.1944	34.0278	33.8659	34.3657	34.0278	34.3657 (38)
Heat transfer coeff	88.5285	87.9583	88.1437	87.7777	87.7777	87.6017	87.4304	87.2638	87.1019	87.6017	87.2638	87.6017 (39)
Average = Sum(39)m / 12 =												87.6709 (39)
HLP	1.1206	1.1134	1.1157	1.1111	1.1111	1.1089	1.1067	1.1046	1.1026	1.1089	1.1046	1.1089 (40)
HLP (average)												1.1098 (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												2.4436 (42)
Average daily hot water use (litres/day)												92.2358 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571 (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	21.8118	19.6691	21.7119	20.9384	21.5831	20.8255	21.4815	21.5474	20.8870	21.6586	21.0447	21.7909 (61)
Total heat required for water heating calculated for each month	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (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	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (64)
Heat gains from water heating, kWh/month	55.4813	48.6724	50.5794	44.5987	43.1666	37.7997	35.5729	40.0446	40.2935	46.2874	49.8769	53.8976 (65)
Total per year (kWh/year) = Sum(64)m =												1706.1784 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.6270	48.5192	39.4585	29.8726	22.3301	18.8520	20.3703	26.4781	35.5388	45.1247	52.6672	56.1453 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	74.5717	72.4292	67.9830	61.9426	58.0196	52.4996	47.8130	53.8235	55.9632	62.2142	69.2735	72.4429 (72)
Total internal gains	557.5611	552.6770	530.6876	497.0031	462.7424	432.3201	414.8390	423.5912	443.2741	477.1692	514.5662	542.6379 (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					4.6800	25.1925	0.6200		0.7000		0.7700	35.4602 (76)
West					4.1400	25.1925	0.6200		0.7000		0.7700	31.3686 (80)
Solar gains	66.8288	111.2028	184.1133	269.0154	312.3635	346.9310	327.8648	289.2774	225.7864	142.2530	83.0539	54.0200 (83)
Total gains	624.3899	663.8798	714.8009	766.0186	775.1059	779.2510	742.7038	712.8686	669.0605	619.4221	597.6200	596.6579 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.5335	44.8222	44.7279	44.9144	44.9144	45.0046	45.0928	45.1789	45.2629	45.0046	45.1789	45.0046
alpha	3.9689	3.9881	3.9819	3.9943	3.9943	4.0003	4.0062	4.0119	4.0175	4.0003	4.0119	4.0003
util living area	0.9784	0.9713	0.9488	0.8929	0.7842	0.5973	0.4479	0.4642	0.7146	0.9010	0.9632	0.9809 (86)
MIT	19.7462	19.8648	20.1433	20.4978	20.7867	20.9477	20.9871	20.9855	20.8908	20.5633	20.1230	19.7397 (87)
Th 2	19.9840	19.9899	19.9880	19.9918	19.9918	19.9936	19.9954	19.9971	19.9987	19.9936	19.9971	19.9936 (88)
util rest of house	0.9733	0.9646	0.9363	0.8660	0.7293	0.5075	0.3378	0.3510	0.6328	0.8696	0.9530	0.9763 (89)
MIT 2	18.3434	18.5179	18.9146	19.4097	19.7832	19.9581	19.9903	19.9913	19.9124	19.5094	18.8969	18.3409 (90)
Living area fraction	18.6250	18.7883	19.1612	19.6281	19.9846	20.1568	20.1904	20.1909	fLA = Living area / (4) =	19.7210	19.1430	0.2008 (91)
MIT	18.6250	18.7883	19.1612	19.6281	19.9846	20.1568	20.1904	20.1909	20.1088	19.7210	19.1430	18.6217 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4750	18.6383	19.0112	19.4781	19.8346	20.0068	20.0404	20.0409	19.9588	19.5710	18.9930	18.4717 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	601.1847	632.2834	658.2122	650.7277	557.8146	396.4472	254.6714	253.8901	420.9916	528.5690	561.3592	576.7294 (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	1201.7755	1173.2117	1058.7155	875.8563	643.8162	412.3210	257.0806	256.6317	458.0557	715.7909	968.0206	1180.1450 (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	446.8396	363.5038	297.9745	162.0926	63.9852	0.0000	0.0000	0.0000	0.0000	139.2931	292.7962	448.9412 (98)
Space heating												2215.4261 (98)
Space heating per m2												28.0434 (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													2461.5845 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	446.8396	363.5038	297.9745	162.0926	63.9852	0.0000	0.0000	0.0000	0.0000	139.2931	292.7962	448.9412	(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)	496.4884	403.8931	331.0828	180.1028	71.0946	0.0000	0.0000	0.0000	0.0000	154.7701	325.3291	498.8236	(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	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047	(64)
Efficiency of water heater	89.0568	89.0045	88.8308	88.4439	87.7335	86.7000	86.7000	86.7000	86.7000	88.2885	88.8286	89.0787	(216)
(217)m													(217)
Fuel for water heating, kWh/month	193.4419	169.9504	177.3096	157.5310	154.0796	137.0825	129.5457	145.0766	145.7507	163.7633	174.7495	188.0412	(219)
Water heating fuel used												1936.3220	(219)
Annual totals kWh/year													
Space heating fuel - main system												2461.5845	(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)												385.8922	(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												4413.3992	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2461.5845	3.9300	96.7403 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1936.3220	3.9300	76.0975 (247)
Pumps and fans for heating	75.0000	17.5600	13.1700 (249)
Energy for lighting	385.8922	17.5600	67.7627 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-445.3995	17.5600	-78.2122 (252)
Total energy cost			263.5582 (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	2461.5845	0.2160	531.7023 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1936.3220	0.2160	418.2455 (264)
Space and water heating			949.9478 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	385.8922	0.5190	200.2781 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	0.5190	-231.1624 (269)
Total kg/year			957.9885 (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	2461.5845	1.2200	3003.1331 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1936.3220	1.2200	2362.3128 (264)
Space and water heating			5365.4459 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	385.8922	3.0700	1184.6891 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			5413.0085 (272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Primary energy kWh/m²/year

68.5191 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 88

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E	Low energy lighting
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Already installed
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
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 30	-189 kg (19.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30	2.40 kg/m ²	B 87 B 90
Total Savings	£30	2.40 kg/m ²	

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

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	£81	£90	-£9
Mains gas	£261	£222	£39
Space heating	£198	£198	£0
Water heating	£76	£46	£30
Lighting	£68	£68	£0
Generated (PV)	-£78	-£78	£0
Total cost of fuels	£264	£234	£30
Total cost of uses	£264	£234	£30
Delivered energy	56 kWh/m ²	44 kWh/m ²	12 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	0.8 tonnes	0.2 tonnes
CO2 emissions per m ²	12 kg/m ²	10 kg/m ²	2 kg/m ²
Primary energy	69 kWh/m ²	55 kWh/m ²	13 kWh/m ²

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	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										30.0000 / (5) =							0.1589 (8)
Pressure test										Yes							
Measured/design AP50																	4.9900
Infiltration rate																	0.4084 (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) =							0.3471 (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	0.4426	0.4339	0.4252	0.3818	0.3732	0.3298	0.3298	0.3211	0.3471	0.3732	0.3905	0.4079	(22b)				
Effective ac	0.5979	0.5941	0.5904	0.5729	0.5696	0.5544	0.5544	0.5516	0.5603	0.5696	0.5763	0.5832	(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						
Solid Door			2.1300	0.9000	1.9170			(26)					
Window (Uw = 1.40)			8.8200	1.3258	11.6932			(27)					
Half Glaze			2.1200	1.4000	2.9680			(26a)					
Heat Loss Floor 1			39.5000	0.1500	5.9250	75.0000	2962.5000	(28a)					
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.2500	9.2075	60.0000	2209.8000	(29a)					
Wall to Unheated Roof			3.8300	0.2900	1.1107	110.0000	421.3000	(29a)					
E-WM-28 To Drive Through	15.1300		15.1300	0.3000	4.5390	110.0000	1664.3000	(29a)					
External Roof 1	39.5000		39.5000	0.1300	5.1350	9.0000	355.5000	(30)					
Total net area of external elements Aum(A, m2)			147.8600					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.4954			(33)					
Party Wall 1			52.9800	0.0000	0.0000	45.0000	2384.1000	(32)					
GF			55.8100			9.0000	502.2900	(32c)					
FF			73.3500			9.0000	660.1500	(32c)					
GF Block			21.4800			75.0000	1611.0000	(32c)					
Internal Floor 1			39.5000			18.0000	711.0000	(32d)					
Internal Floor 1			39.5000			18.0000	711.0000	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14192.9400	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							179.6575	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7406	(36)					
Total fabric heat loss						(33) + (36) =	53.2360	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 37.2563	Feb 37.0193	Mar 36.7870	Apr 35.6960	May 35.4919	Jun 34.5417	Jul 34.5417	Aug 34.3657	Sep 34.9077	Oct 35.4919	Nov 35.9048	Dec 36.3365	(38)
Heat transfer coeff	90.4923	90.2553	90.0230	88.9320	88.7279	87.7777	87.7777	87.6017	88.1437	88.7279	89.1408	89.5726	(39)
Average = Sum(39)m / 12 =												88.9311	(39)
HLP	Jan 1.1455	Feb 1.1425	Mar 1.1395	Apr 1.1257	May 1.1231	Jun 1.1111	Jul 1.1111	Aug 1.1089	Sep 1.1157	Oct 1.1231	Nov 1.1284	Dec 1.1338	(40)
HLP (average)												1.1257	(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											
2.4436 (42)											
Average daily hot water use (litres/day)											
92.2358 (43)											
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571 (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	21.8118	19.6691	21.7119	20.9384	21.5831	20.8255	21.4815	21.5474	20.8870	21.6586	21.0447	21.7909 (61)
Total heat required for water heating calculated for each month	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (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												1.2497 (H8)
Utilisation factor												0.5508 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.2358 (H14)
Volume ratio Veff/V												0.8131 (H15)
Solar storage volume factor												0.9586 (H16)
Solar input												-841.9491 (H17)
Solar input	-24.4148	-40.7414	-69.3872	-92.9925	-114.8844	-112.9497	-111.4570	-97.3806	-76.2685	-52.0824	-28.9595	-20.4311 (63)
Solar input (sum of months) = Sum (63)m =												-841.9491 (63)
Output from w/h	147.8583	110.5222	88.1184	46.3341	20.2950	5.9008	0.8591	28.4008	50.0974	92.5017	126.2680	147.0736 (64)
Total per year (kWh/year) = Sum (64)m =												864.2293 (64)
Heat gains from water heating, kWh/month	55.4813	48.6724	50.5794	44.5987	43.1666	37.7997	35.5729	40.0446	40.2935	46.2874	49.8769	53.8976 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.6270	48.5192	39.4585	29.8726	22.3301	18.8520	20.3703	26.4781	35.5388	45.1247	52.6672	56.1453	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	74.5717	72.4292	67.9830	61.9426	58.0196	52.4996	47.8130	53.8235	55.9632	62.2142	69.2735	72.4429	(72)
Total internal gains	557.5611	552.6770	530.6876	497.0031	462.7424	432.3201	414.8390	423.5912	443.2741	477.1692	514.5662	542.6379	(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			4.6800		19.6403		0.6200		0.7000		0.7700		27.6450 (76)	
West			4.1400		19.6403		0.6200		0.7000		0.7700		24.4552 (80)	

Solar gains	52.1001	101.9189	167.8459	244.7933	300.0034	307.1068	292.3782	251.1486	195.2118	120.9354	64.9627	42.8446 (83)		
Total gains	609.6613	654.5959	698.5335	741.7964	762.7458	739.4269	707.2173	674.7398	638.4859	598.1045	579.5289	585.4826 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.5671	43.6815	43.7942	44.3314	44.4334	44.9144	44.9144	45.0046	44.7279	44.4334	44.2276	44.0144
alpha	3.9045	3.9121	3.9196	3.9554	3.9622	3.9943	3.9943	4.0003	3.9819	3.9622	3.9485	3.9343
util living area	0.9826	0.9752	0.9580	0.9153	0.8286	0.6781	0.5229	0.5641	0.7794	0.9286	0.9729	0.9850 (86)
MIT	19.6039	19.7522	20.0250	20.3893	20.7028	20.9069	20.9746	20.9655	20.8296	20.4347	19.9624	19.5756 (87)
Th 2	19.9639	19.9663	19.9687	19.9799	19.9820	19.9918	19.9918	19.9936	19.9880	19.9820	19.9777	19.9733 (88)
util rest of house	0.9785	0.9695	0.9477	0.8935	0.7833	0.5966	0.4132	0.4545	0.7093	0.9058	0.9655	0.9815 (89)
MIT 2	18.1237	18.3395	18.7330	19.2535	19.6724	19.9192	19.9793	19.9752	19.8388	19.3269	18.6535	18.0891 (90)
Living area fraction									fLA = Living area / (4) =			0.2008 (91)
MIT	18.4209	18.6231	18.9924	19.4815	19.8793	20.1175	20.1791	20.1740	20.0377	19.5493	18.9162	18.3876 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2709	18.4731	18.8424	19.3315	19.7293	19.9675	20.0291	20.0240	19.8877	19.3993	18.7662	18.2376 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9691	0.9580	0.9330	0.8765	0.7704	0.5945	0.4174	0.4580	0.7014	0.8890	0.9534	0.9730	(94)
Useful gains	590.8328	627.0717	651.6986	650.1678	587.5848	439.5707	295.2187	309.0388	447.8023	531.7435	552.5326	569.6532	(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	1264.2556	1225.0441	1111.0968	927.6962	712.4233	471.1442	301.0008	317.4693	510.1477	780.7445	1039.9377	1257.3801	(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	501.0265	401.8374	341.7922	199.8204	92.8798	0.0000	0.0000	0.0000	0.0000	185.2568	350.9317	511.6688	(98)
Space heating												2585.2138	(98)
Space heating per m2												(98) / (4) =	32.7242 (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													2872.4598 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	501.0265	401.8374	341.7922	199.8204	92.8798	0.0000	0.0000	0.0000	0.0000	185.2568	350.9317	511.6688	(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)	556.6961	446.4860	379.7692	222.0227	103.1998	0.0000	0.0000	0.0000	0.0000	205.8409	389.9241	568.5209	(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	147.8583	110.5222	88.1184	46.3341	20.2950	5.9008	0.8591	28.4008	50.0974	92.5017	126.2680	147.0736	(64)
Efficiency of water heater	89.2261	89.2671	89.3033	89.3598	89.3899	86.7000	86.7000	86.7000	86.7000	88.8735	89.1026	86.7000	(216)
(217)m	89.2261	89.2671	89.3033	89.3598	89.3899	86.7000	86.7000	86.7000	86.7000	88.8735	89.1026	86.7000	(217)
Fuel for water heating, kWh/month	165.7118	123.8107	98.6731	51.8511	22.7039	6.8060	0.9909	32.7576	57.7824	104.0824	141.7107	164.8038	(219)
Water heating fuel used												971.6847	(219)
Annual totals kWh/year													
Space heating fuel - main system												2872.4598	(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)													385.8922 (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												3962.8436	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2872.4598	3.4800	99.9616	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	971.6847	3.4800	33.8146	(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	385.8922	13.1900	50.8992	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-392.1930	13.1900	-51.7303	(252)
Total energy cost			269.4326	(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] =	0.9126 (257)
SAP value		87.2693
SAP rating (Section 12)		87 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	2872.4598	0.2160	620.4513 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	971.6847	0.2160	209.8839 (264)
Space and water heating			830.3352 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	385.8922	0.5190	200.2781 (268)
Energy saving/generation technologies			
PV Unit	-392.1930	0.5190	-203.5482 (269)
Total kg/year			891.9401 (272)
CO2 emissions per m2			11.2900 (273)
EI value			90.3613
EI rating			90 (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	39.5000 (1b)	x 2.3100 (2b)	= 91.2450 (1b) - (3b)
First floor	39.5000 (1c)	x 2.4700 (2c)	= 97.5650 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 188.8100 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour											
										heating	heating														
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)								
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)								
Number of intermittent fans																3 * 10 =	30.0000 (7a)								
Number of passive vents																0 * 10 =	0.0000 (7b)								
Number of flueless gas fires																0 * 40 =	0.0000 (7c)								
										Air changes per hour															
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1589 (8)								
Pressure test										Yes															
Measured/design AP50										4.9900															
Infiltration rate										0.4084 (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) =					0.3471 (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													0.3645	0.3385	0.3471	0.3298	0.3298	0.3211	0.3124	0.3037	0.2951	0.3211	0.3037	0.3211 (22b)	
Effective ac													0.5664	0.5573	0.5603	0.5544	0.5544	0.5516	0.5488	0.5461	0.5435	0.5516	0.5461	0.5516 (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 Door			2.1300	0.9000	1.9170		(26)
Window (Uw = 1.40)			8.8200	1.3258	11.6932		(27)
Half Glaze			2.1200	1.4000	2.9680		(26a)
Heat Loss Floor 1			39.5000	0.1500	5.9250	75.0000	2962.5000 (28a)
100mm Knauf Supafil	49.9000	13.0700	36.8300	0.2500	9.2075	60.0000	2209.8000 (29a)
Wall to Unheated Roof			3.8300	0.2900	1.1107	110.0000	421.3000 (29a)
E-WM-28 To Drive Through			15.1300	0.3000	4.5390	110.0000	1664.3000 (29a)
External Roof 1	39.5000		39.5000	0.1300	5.1350	9.0000	355.5000 (30)
Total net area of external elements Aum(A, m ²)			147.8600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.4954		(33)
Party Wall 1			52.9800	0.0000	0.0000	45.0000	2384.1000 (32)
GF			55.8100			9.0000	502.2900 (32c)
FF			73.3500			9.0000	660.1500 (32c)
GF Block			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			39.5000			18.0000	711.0000 (32d)
Internal Floor 1			39.5000			18.0000	711.0000 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	14192.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							179.6575 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7406 (36)
Total fabric heat loss						(33) + (36) =	53.2360 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	35.2925	34.7223	34.9077	34.5417	34.5417	34.3657	34.1944	34.0278	33.8659	34.3657	34.0278	34.3657 (38)
Heat transfer coeff	88.5285	87.9583	88.1437	87.7777	87.7777	87.6017	87.4304	87.2638	87.1019	87.6017	87.2638	87.6017 (39)
Average = Sum(39)m / 12 =												87.6709 (39)
HLP	1.1206	1.1134	1.1157	1.1111	1.1111	1.1089	1.1067	1.1046	1.1026	1.1089	1.1046	1.1089 (40)
HLP (average)												1.1098 (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												2.4436 (42)
Average daily hot water use (litres/day)												92.2358 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594 (44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m												
	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571 (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	21.8118	19.6691	21.7119	20.9384	21.5831	20.8255	21.4815	21.5474	20.8870	21.6586	21.0447	21.7909 (61)
Total heat required for water heating calculated for each month	172.2731	151.2636	157.5056	139.3266	135.1794	118.8505	112.3161	125.7814	126.3659	144.5841	155.2275	167.5047 (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												1.3986 (H8)
Utilisation factor												0.5108 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												92.2358 (H14)
Volume ratio Veff/V												0.8131 (H15)
Solar storage volume factor												0.9586 (H16)
Solar input												-873.9196 (H17)
Solar input	-28.5094	-40.5385	-69.6760	-94.0090	-110.4192	-117.9452	-115.4648	-103.3445	-80.9116	-55.9395	-33.7191	-23.4430 (63)
Solar input (sum of months) = Sum (63)m =												-873.9196 (63)
Output from w/h	143.7638	110.7250	87.8296	45.3176	24.7602	0.9054	0.0000	22.4369	45.4543	88.6446	121.5084	144.0617 (64)
Total per year (kWh/year) = Sum (64)m =												835.4074 (64)
Heat gains from water heating, kWh/month	55.4813	48.6724	50.5794	44.5987	43.1666	37.7997	35.5729	40.0446	40.2935	46.2874	49.8769	53.8976 (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	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.6270	48.5192	39.4585	29.8726	22.3301	18.8520	20.3703	26.4781	35.5388	45.1247	52.6672	56.1453 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053 (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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445 (71)
Water heating gains (Table 5)	74.5717	72.4292	67.9830	61.9426	58.0196	52.4996	47.8130	53.8235	55.9632	62.2142	69.2735	72.4429 (72)
Total internal gains	557.5611	552.6770	530.6876	497.0031	462.7424	432.3201	414.8390	423.5912	443.2741	477.1692	514.5662	542.6379 (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					4.6800	25.1925	0.6200	0.7000	0.7700		35.4602 (76)	
West					4.1400	25.1925	0.6200	0.7000	0.7700		31.3686 (80)	

Solar gains	66.8288	111.2028	184.1133	269.0154	312.3635	346.9310	327.8648	289.2774	225.7864	142.2530	83.0539	54.0200 (83)
Total gains	624.3899	663.8798	714.8009	766.0186	775.1059	779.2510	742.7038	712.8686	669.0605	619.4221	597.6200	596.6579 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	44.5335	44.8222	44.7279	44.9144	44.9144	45.0046	45.0928	45.1789	45.2629	45.0046	45.1789	45.0046
alpha	3.9689	3.9881	3.9819	3.9943	3.9943	4.0003	4.0062	4.0119	4.0175	4.0003	4.0119	4.0003
util living area	0.9784	0.9713	0.9488	0.8929	0.7842	0.5973	0.4479	0.4642	0.7146	0.9010	0.9632	0.9809 (86)
MIT	19.7462	19.8648	20.1433	20.4978	20.7867	20.9477	20.9871	20.9855	20.8908	20.5633	20.1230	19.7397 (87)
Th 2	19.9840	19.9899	19.9880	19.9918	19.9918	19.9936	19.9954	19.9971	19.9987	19.9936	19.9971	19.9936 (88)
util rest of house	0.9733	0.9646	0.9363	0.8660	0.7293	0.5075	0.3378	0.3510	0.6328	0.8696	0.9530	0.9763 (89)
MIT 2	18.3434	18.5179	18.9146	19.4097	19.7832	19.9581	19.9903	19.9913	19.9124	19.5094	18.8969	18.3409 (90)
Living area fraction									fLA = Living area / (4) =			0.2008 (91)
MIT	18.6250	18.7883	19.1612	19.6281	19.9846	20.1568	20.1904	20.1909	20.1088	19.7210	19.1430	18.6217 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.4750	18.6383	19.0112	19.4781	19.8346	20.0068	20.0404	20.0409	19.9588	19.5710	18.9930	18.4717 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9628	0.9524	0.9208	0.8495	0.7197	0.5088	0.3429	0.3562	0.6292	0.8533	0.9393	0.9666	(94)
Useful gains	601.1847	632.2834	658.2122	650.7277	557.8146	396.4472	254.6714	253.8901	420.9916	528.5690	561.3592	576.7294	(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	1201.7755	1173.2117	1058.7155	875.8563	643.8162	412.3210	257.0806	256.6317	458.0557	715.7909	968.0206	1180.1450	(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	446.8396	363.5038	297.9745	162.0926	63.9852	0.0000	0.0000	0.0000	0.0000	139.2931	292.7962	448.9412	(98)
Space heating												2215.4261	(98)
Space heating per m2											(98) / (4) =	28.0434	(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													2461.5845	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	446.8396	363.5038	297.9745	162.0926	63.9852	0.0000	0.0000	0.0000	0.0000	139.2931	292.7962	448.9412	(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)	496.4884	403.8931	331.0828	180.1028	71.0946	0.0000	0.0000	0.0000	0.0000	154.7701	325.3291	498.8236	(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	143.7638	110.7250	87.8296	45.3176	24.7602	0.9054	0.0000	22.4369	45.4543	88.6446	121.5084	144.0617	(64)	
Efficiency of water heater	89.1738	89.2072	89.2268	89.2577	89.0543	86.7000	86.7000	86.7000	86.7000	88.6872	89.0064	89.1754	(216)	
Fuel for water heating, kWh/month	161.2175	124.1212	98.4341	50.7716	27.8035	1.0442	0.0000	25.8788	52.4271	99.9519	136.5165	161.5486	(219)	
Water heating fuel used												939.7150	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2461.5845	(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)													385.8922	(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												3466.7922	(238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2461.5845	3.9300	96.7403	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	939.7150	3.9300	36.9308	(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	385.8922	17.5600	67.7627	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-445.3995	17.5600	-78.2122	(252)
Total energy cost			233.1716	(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	2461.5845	0.2160	531.7023	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	939.7150	0.2160	202.9784	(264)
Space and water heating			734.6807	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	385.8922	0.5190	200.2781	(268)

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Energy saving/generation technologies			
PV Unit	-445.3995	0.5190	-231.1624 (269)
Total kg/year			768.6714 (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	2461.5845	1.2200	3003.1331 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	939.7150	1.2200	1146.4523 (264)
Space and water heating			4149.5854 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	385.8922	3.0700	1184.6891 (268)
Energy saving/generation technologies			
PV Unit	-445.3995	3.0700	-1367.3766 (269)
Primary energy kWh/year			4350.6479 (272)
Primary energy kWh/m2/year			55.0715 (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	179.7 (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	249.23 (P1)
Transmission heat loss coefficient	53.24 (37)
Summer heat loss coefficient	302.47 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	4.6800	125.2818	0.6200	0.7000	0.9000	206.1145
West	4.1400	125.2818	0.6200	0.7000	0.9000	182.3321
total:						388.4465

	Jun	Jul	Aug	
Solar gains	418	388	342	(P3)
Internal gains	429	412	421	
Total summer gains	847	800	762	(P5)
Summer gain/loss ratio	2.80	2.65	2.52	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 179.7)	0.74	0.74	0.74	
Threshold temperature	18.94	20.69	20.56	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			