

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property Reference	4907-T511-3796-176				Issued on Date	30/09/2022
Assessment Reference	As Built	Prop Type Ref	A Mid As			
Property	13, Belmere Drive, Fair Oak, EASTLEIGH, SO50 7QS					
SAP Rating	87 B	DER	12.84	TER	16.93	
Environmental	90 B	% DER<TER	24.16			
CO ₂ Emissions (t/year)	0.81	DFEE	35.24	TFEE	42.11	
General Requirements Compliance	Pass	% DFEE<TFEE	16.31			
Assessor Details	Miss Lindsey Dean, Lindsey Dean, Tel: 01884 242050, Lindsey.dean@aessc.co.uk				Assessor ID	T510-0001
Client	Drew Smith					

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

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DWELLING AS BUILT

Mid-Terrace House, total floor area 78 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 16.93 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.84 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 42.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 35.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.19 (max. 0.30)	0.19 (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	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.38 (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: 4.33 (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
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% 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

Continuous extract system (decentralised)
Specific fan power: 0.1700 0.1800
Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 3.33 m², No overhang
Windows facing South: 5.33 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Photovoltaic array 0.32 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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.3300
Infiltration rate												0.2165 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2003 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2553	0.2503	0.2453	0.2203	0.2153	0.1902	0.1902	0.1852	0.2003	0.2153	0.2253	0.2353 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5053	0.5003	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.1233	Feb 32.7951	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	71.9725	71.6443	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6537 (39)
HLP	Jan 0.9204	Feb 0.9162	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9163 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	

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Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (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	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)
Total per year (kWh/year) = Sum(64)m =												1610.5098 (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	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	371.4855	369.1659	355.5066	333.6869	311.6359	290.5233	276.9508	283.1174	294.4840	316.5135	341.6828	360.4577 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North				3.3300	10.6334	0.7200	0.7000		0.7700		12.3674 (74)	
South				1.5300	46.7521	0.7200	0.7000		0.7700		24.9837 (78)	
South				3.8000	46.7521	0.7200	0.7000		0.7700		62.0509 (78)	
Solar gains	99.4020	166.1750	221.7322	269.7239	300.7463	298.8270	287.9316	264.1817	237.9592	181.8771	118.4225	85.5160 (83)
Total gains	470.8875	535.3410	577.2388	603.4108	612.3822	589.3503	564.8824	547.2991	532.4432	498.3907	460.1052	445.9737 (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	31.4120	31.5559	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.0941	3.1037	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9658	0.9483	0.9212	0.8724	0.7872	0.6547	0.5135	0.5454	0.7275	0.8823	0.9489	0.9706 (86)
MIT	19.1936	19.4362	19.7727	20.1761	20.5543	20.8243	20.9393	20.9250	20.7412	20.2611	19.6463	19.1344 (87)
Th 2	20.1502	20.1538	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.9610	0.9412	0.9099	0.8528	0.7521	0.5941	0.4290	0.4622	0.6740	0.8605	0.9406	0.9664 (89)
MIT 2	17.7130	18.0649	18.5483	19.1203	19.6399	19.9850	20.1106	20.0975	19.8890	19.2480	18.3727	17.6298 (90)
Living area fraction	17.8664	18.2069	18.6751	19.2297	19.7346	20.0719	20.1964	20.1833	19.9773	19.3529	18.5047	17.7857 (92)
MIT	17.8664	18.2069	18.6751	19.2297	19.7346	20.0719	20.1964	20.1833	19.9773	19.3529	18.5047	17.7857 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.7164	18.0569	18.5251	19.0797	19.5846	19.9219	20.0464	20.0333	19.8273	19.2029	18.3547	17.6357 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9414	0.9172	0.8819	0.8226	0.7249	0.5758	0.4175	0.4494	0.6506	0.8298	0.9163	0.9485 (94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	965.6086	942.6189	861.2736	729.0968	564.7180	381.1712	246.8440	260.2236	410.2037	616.1672	806.0898	962.3001 (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	388.6137	303.4620	262.0293	167.5743	89.8786	0.0000	0.0000	0.0000	0.0000	150.7330	276.8218	401.2286 (98)
Space heating												2040.3413 (98)
Space heating per m2												(98) / (4) = 26.0913 (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 %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	2254.5208 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	388.6137	303.4620	262.0293	167.5743	89.8786	0.0000	0.0000	0.0000	0.0000	150.7330	276.8218	401.2286 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	429.4074	335.3171	289.5352	185.1650	99.3133	0.0000	0.0000	0.0000	0.0000	166.5558	305.8804	443.3465 (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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Efficiency of water heater (217)m	89.5263	89.4459	89.3117	89.0647	88.5975	87.3000	87.3000	87.3000	87.3000	88.9508	89.3626	87.3000 (216)
Fuel for water heating, kWh/month	183.1481	160.7573	167.1697	147.6167	143.4864	127.3000	119.5890	134.9162	135.8416	153.4078	164.7918	177.7726 (219)
Water heating fuel used												1815.7973 (219)
Annual totals kWh/year												2254.5208 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
Electricity for pumps and fans:												
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)												
mechanical ventilation fans (SFP = 0.2282)												55.2921 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												130.2921 (231)
Electricity for lighting (calculated in Appendix L)												383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 0.32 * 1068 * 1.00) =											-273.4260	-273.4260 (233)
Total delivered energy for all uses												4310.7371 (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	2254.5208	0.2160	486.9765 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1815.7973	0.2160	392.2122 (264)
Space and water heating			879.1887 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-273.4260	0.5190	-141.9081 (269)
Total CO2, kg/year			1003.9662 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.8400 (273)

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

DER		12.8400 ZC1
Total Floor Area	TFA	78.2000
Assumed number of occupants	N	2.4278
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.3404 ZC2
CO2 emissions from cooking, equation (L16)		2.2669 ZC3
Total CO2 emissions		31.4473 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		31.4473 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (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) =	0.1510 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4010 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3710 (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	0.4730	0.4637	0.4544	0.4081	0.3988	0.3524	0.3524	0.3431	0.3710	0.3988	0.4173	0.4359	(22b)				
Effective ac	0.6119	0.6075	0.6033	0.5833	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.6600	1.3258	11.4811		(27)					
150mm EPS B&B			39.1000	0.1300	5.0830		(28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1800	5.6484		(29a)					
400mm Mineral Wool	39.1000		39.1000	0.1300	5.0830		(30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		29.4155		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2602 (36)					
Total fabric heat loss						(33) + (36) =	37.6757 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.1052	Feb 39.8205	Mar 39.5414	Apr 38.2307	May 37.9855	Jun 36.8439	Jul 36.8439	Aug 36.6325	Sep 37.2836	Oct 37.9855	Nov 38.4816	Dec 39.0002 (38)
Heat transfer coeff	77.7808	77.4961	77.2171	75.9064	75.6611	74.5195	74.5195	74.3081	74.9593	75.6611	76.1572	76.6759 (39)
Average = Sum(39)m / 12 =												75.9052 (39)
HLP	Jan 0.9946	Feb 0.9910	Mar 0.9874	Apr 0.9707	May 0.9675	Jun 0.9529	Jul 0.9529	Aug 0.9502	Sep 0.9586	Oct 0.9675	Nov 0.9739	Dec 0.9805 (40)
HLP (average)												0.9707 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
Daily hot water use	Jan 101.0468	Feb 97.3724	Mar 93.6979	Apr 90.0235	May 86.3491	Jun 82.6747	Jul 82.6747	Aug 86.3491	Sep 90.0235	Oct 93.6979	Nov 97.3724	Dec 101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)										Total = Sum(45)m =		1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (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												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	44.8180	47.7474	44.3952	44.0025	40.7711	42.1301	44.0025	44.3952	47.7474	48.0193	50.9589 (61)
Solar input	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801 (64)
	62.5647	54.7817	56.9047	50.3028	48.6178	42.6535	40.6122	45.5175	46.0279	52.6434	56.4391	60.9925 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	84.0923	81.5204	76.4847	69.8650	65.3465	59.2410	54.5863	61.1794	63.9276	70.7572	78.3877	81.9792	(72)
Total internal gains	383.8654	381.1029	366.8261	344.3909	321.7205	299.9902	286.4246	293.2084	305.1977	327.8427	353.6252	372.8414	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					3.3300	10.6334	0.6300		0.7000	0.7700		10.8215
South					5.3300	46.7521	0.6300		0.7000	0.7700		76.1552 (74)
Solar gains	86.9768	145.4031	194.0157	236.0084	263.1530	261.4736	251.9402	231.1590	208.2143	159.1425	103.6197	74.8265 (83)
Total gains	470.8422	526.5060	560.8418	580.3994	584.8735	561.4638	538.3648	524.3674	513.4120	486.9852	457.2448	447.6679 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	69.8187	70.0752	70.3284	71.5428	71.7747	72.8742	72.8742	73.0816	72.4468	71.7747	71.3072	70.8248	
alpha	5.6546	5.6717	5.6886	5.7695	5.7850	5.8583	5.8583	5.8721	5.8298	5.7850	5.7538	5.7217	
util living area	0.9979	0.9957	0.9901	0.9727	0.9190	0.7764	0.5956	0.6324	0.8567	0.9753	0.9954	0.9985	(86)
MIT	19.9753	20.1052	20.3016	20.5606	20.7936	20.9489	20.9910	20.9873	20.9037	20.6125	20.2513	19.9576	(87)
Th 2	20.0878	20.0908	20.0938	20.1078	20.1105	20.1227	20.1227	20.1250	20.1180	20.1105	20.1052	20.0996	(88)
util rest of house	0.9973	0.9942	0.9866	0.9622	0.8861	0.6970	0.4839	0.5219	0.7932	0.9637	0.9937	0.9979	(89)
MIT 2	18.7149	18.9066	19.1941	19.5763	19.8956	20.0859	20.1191	20.1193	20.0380	19.6551	19.1309	18.6977	(90)
Living area fraction	18.8454	19.0307	19.3088	19.6783	19.9886	20.1753	20.2094	20.2092	20.1277	19.7543	19.2470	18.8282	(91)
MIT	18.8454	19.0307	19.3088	19.6783	19.9886	20.1753	20.2094	20.2092	20.1277	19.7543	19.2470	18.8282	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8454	19.0307	19.3088	19.6783	19.9886	20.1753	20.2094	20.2092	20.1277	19.7543	19.2470	18.8282	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9959	0.9918	0.9824	0.9556	0.8806	0.7022	0.4953	0.5331	0.7940	0.9574	0.9912	0.9969	(94)
Ext temp.	468.9031	522.1788	550.9881	554.6067	515.0599	394.2701	266.6394	279.5195	407.6310	466.2423	453.1994	446.2609	(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	1131.3553	1095.0757	989.0611	818.1396	627.1232	415.4658	268.9687	283.0580	451.8313	692.6213	925.0797	1121.6325	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	492.8644	384.9868	325.9263	189.7437	83.3751	0.0000	0.0000	0.0000	0.0000	168.4260	339.7538	502.4765	(98)
												2487.5526	(98)
												31.8101	(99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2663.3326 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	492.8644	384.9868	325.9263	189.7437	83.3751	0.0000	0.0000	0.0000	0.0000	168.4260	339.7538	502.4765	(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)	527.6921	412.1914	348.9575	203.1517	89.2667	0.0000	0.0000	0.0000	0.0000	180.3276	363.7621	537.9834	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	200.8084	175.8773	182.9889	162.3020	157.1369	138.3974	132.5953	147.8127	149.4451	170.1730	181.6563	196.0801	(64)
Efficiency of water heater (217)m	87.2241	86.9697	86.4885	85.4453	83.5354	80.3000	80.3000	80.3000	80.3000	85.0252	86.6049	87.3173	(217)
Fuel for water heating, kWh/month	230.2213	202.2281	211.5760	189.9484	188.1083	172.3505	165.1249	184.0755	186.1085	200.1441	209.7529	224.5606	(219)
Water heating fuel used												2364.1990	(219)
Annual totals kWh/year													
Space heating fuel - main system												2663.3326	(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)												383.5529	(232)
Total delivered energy for all uses												5486.0844	(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	2663.3326	0.2160	575.2798 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2364.1990	0.2160	510.6670 (264)
Space and water heating			1085.9468 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Total CO2, kg/m2/year			1323.9358 (272)
Emissions per m2 for space and water heating			13.8868 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5456 (272b)
Emissions per m2 for pumps and fans			0.4978 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.8868 * 1.00) + 2.5456 + 0.4978, rounded to 2 d.p.			16.9300 (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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1510 (8)
Pressure test					Yes
Measured/design AP50					4.3300
Infiltration rate					0.3675 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3400 (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	0.4335	0.4250	0.4165	0.3740	0.3655	0.3230	0.3230	0.3145	0.3400	0.3655	0.3825	0.3995 (22b)
Effective ac	0.5939	0.5903	0.5867	0.5699	0.5668	0.5522	0.5522	0.5494	0.5578	0.5668	0.5731	0.5798 (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			2.1200	1.3000	2.7560		(26)
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)
150mm EPS B&B			39.1000	0.1500	5.8650	75.0000	2932.5000 (28a)
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (28a)
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)
Total net area of external elements Aum(A, m ²)			120.3600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)
Timber Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (32)
Timber GF			62.6100			9.0000	563.4900 (32c)
Timber FF			75.8400			9.0000	682.5600 (32c)
Internal Floor			39.1000			18.0000	703.8000 (32d)
Internal Ceiling			39.1000			9.0000	351.9000 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 7786.9700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							99.5776 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)
Total fabric heat loss							(33) + (36) = 38.8492 (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	38.9315	38.6923	38.4580	37.3571	37.1511	36.1923	36.1923	36.0147	36.5616	37.1511	37.5678	38.0034 (38)
Heat transfer coeff	77.7806	77.5415	77.3071	76.2063	76.0003	75.0415	75.0415	74.8639	75.4108	76.0003	76.4170	76.8526 (39)
Average = Sum(39)m / 12 =												76.2053 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9946	0.9916	0.9886	0.9745	0.9719	0.9596	0.9596	0.9573	0.9643	0.9719	0.9772	0.9828 (40)
HLP (average)												0.9745 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1445.3269 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.8430	27.8501	28.7388	25.0552	24.0411	20.7456	19.2239	22.0596	22.3231	26.0154	28.3979	30.8383 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	42.7998	41.4436	38.6274	34.7989	32.3132	28.8133	25.8385	29.6501	31.0043	34.9670	39.4415	41.4493	(72)
Total internal gains	339.5729	338.0261	325.9688	306.3248	285.6872	266.5625	254.6768	258.6790	269.2744	289.0525	311.6790	329.3115	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
North	3.3300				10.6334		0.7200		0.7000		0.7700		12.3674 (74)	
South	1.5300				46.7521		0.7200		0.7000		0.7700		24.9837 (78)	
South	3.8000				46.7521		0.7200		0.7000		0.7700		62.0509 (78)	
Solar gains	99.4020	166.1750	221.7322	269.7239	300.7463	298.8270	287.9316	264.1817	237.9592	181.8771	118.4225	85.5160	(83)	
Total gains	438.9749	504.2011	547.7010	576.0487	586.4335	565.3895	542.6084	522.8607	507.2336	470.9296	430.1015	414.8275	(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	27.8096	27.8953	27.9799	28.3841	28.4610	28.8247	28.8247	28.8931	28.6835	28.4610	28.3059	28.1454	
alpha	2.8540	2.8597	2.8653	2.8923	2.8974	2.9216	2.9216	2.9262	2.9122	2.8974	2.8871	2.8764	
util living area	0.9696	0.9540	0.9299	0.8854	0.8082	0.6815	0.5434	0.5764	0.7538	0.8960	0.9549	0.9738	(86)
MIT	18.8856	19.1399	19.5159	19.9949	20.4315	20.7671	20.9134	20.8945	20.6622	20.1005	19.4125	18.8427	(87)
Th 2	20.0878	20.0904	20.0929	20.1046	20.1068	20.1171	20.1171	20.1190	20.1132	20.1068	20.1024	20.0977	(88)
util rest of house	0.9652	0.9475	0.9195	0.8670	0.7744	0.6204	0.4541	0.4895	0.7013	0.8758	0.9474	0.9700	(89)
MIT 2	18.1406	18.3933	18.7651	19.2402	19.6556	19.9621	20.0741	20.0638	19.8739	19.3498	18.6742	18.1052	(90)
Living area fraction	18.2177	18.4706	18.8428	19.3184	19.7360	20.0454	20.1610	20.1499	19.9556	19.4276	18.7507	18.1816	(91)
MIT	18.2177	18.4706	18.8428	19.3184	19.7360	20.0454	20.1610	20.1499	19.9556	19.4276	18.7507	18.1816	(92)
Temperature adjustment	18.2177	18.4706	18.8428	19.3184	19.7360	20.0454	20.1610	20.1499	19.9556	19.4276	18.7507	18.1816	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	418.4899	470.1828	493.8515	488.3957	444.7005	347.7048	248.9656	257.6567	350.3821	403.6503	401.1791	397.9212	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1082.5314	1052.2870	954.1880	793.9438	610.7378	408.6335	267.2249	280.7311	441.5719	670.8976	890.3074	1074.5201	(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	494.0469	391.1741	342.4904	219.9946	123.5317	0.0000	0.0000	0.0000	0.0000	198.8320	352.1723	503.3896	(98)
Space heating													2625.6316 (98)
Space heating per m2													33.5759 (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	705.3897	555.3068	568.9656	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7685	0.8340	0.8179	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	542.0916	463.1185	465.3631	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	752.3608	723.9594	702.7424	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	151.3939	194.0656	176.6101	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												522.0696 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	37.8485	48.5164	44.1525	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												130.5174 (107)
Space cooling per m2												1.6690 (108)
Energy for space heating												33.5759 (99)
Energy for space cooling												1.6690 (108)
Total												35.2449 (109)
Dwelling Fabric Energy Efficiency (DFEE)												35.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (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) =	0.1510 (8)		
Pressure test														Yes			
Measured/design AP50														5.0000			
Infiltration rate														0.4010 (18)			
Number of sides sheltered														1 (19)			
Shelter factor										(20) = 1 - [0.075 x (19)] =				0.9250 (20)			
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =				0.3710 (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	0.4730	0.4637	0.4544	0.4081	0.3988	0.3524	0.3524	0.3431	0.3710	0.3988	0.4173	0.4359 (22b)					
Effective ac	0.6119	0.6075	0.6033	0.5833	0.5795	0.5621	0.5621	0.5589	0.5688	0.5795	0.5871	0.5950 (25)					

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1200	1.0000	2.1200		(26)					
TER Opening Type (Uw = 1.40)			8.6600	1.3258	11.4811		(27)					
150mm EPS B&B			39.1000	0.1300	5.0830		(28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1800	5.6484		(29a)					
400mm Mineral Wool	39.1000		39.1000	0.1300	5.0830		(30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		29.4155		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2602 (36)					
Total fabric heat loss						(33) + (36) =	37.6757 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.1052	Feb 39.8205	Mar 39.5414	Apr 38.2307	May 37.9855	Jun 36.8439	Jul 36.8439	Aug 36.6325	Sep 37.2836	Oct 37.9855	Nov 38.4816	Dec 39.0002 (38)
Heat transfer coeff	77.7808	77.4961	77.2171	75.9064	75.6611	74.5195	74.5195	74.3081	74.9593	75.6611	76.1572	76.6759 (39)
Average = Sum(39)m / 12 =												75.9052 (39)
HLP	Jan 0.9946	Feb 0.9910	Mar 0.9874	Apr 0.9707	May 0.9675	Jun 0.9529	Jul 0.9529	Aug 0.9502	Sep 0.9586	Oct 0.9675	Nov 0.9739	Dec 0.9805 (40)
HLP (average)												0.9707 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss	Total = Sum(45)m = 1445.3269 (45)											
	(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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.8430	27.8501	28.7388	25.0552	24.0411	20.7456	19.2239	22.0596	22.3231	26.0154	28.3979	30.8383 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	121.3910	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.7184	19.2900	15.6877	11.8766	8.8779	7.4951	8.0987	10.5270	14.1294	17.9405	20.9392	22.3220	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	215.6375	217.8751	212.2363	200.2320	185.0787	170.8368	161.3223	159.0846	164.7234	176.7277	191.8810	206.1230	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	35.1391	(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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	(71)
Water heating gains (Table 5)	42.7998	41.4436	38.6274	34.7989	32.3132	28.8133	25.8385	29.6501	31.0043	34.9670	39.4415	41.4493	(72)
Total internal gains	339.5729	338.0261	325.9688	306.3248	285.6872	266.5625	254.6768	258.6790	269.2744	289.0525	311.6790	329.3115	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North					3.3300	10.6334	0.6300		0.7000	0.7700	10.8215 (74)	
South					5.3300	46.7521	0.6300		0.7000	0.7700	76.1552 (78)	
Solar gains	86.9768	145.4031	194.0157	236.0084	263.1530	261.4736	251.9402	231.1590	208.2143	159.1425	103.6197	74.8265 (83)
Total gains	426.5496	483.4292	519.9845	542.3332	548.8402	528.0361	506.6170	489.8380	477.4887	448.1950	415.2986	404.1380 (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	69.8187	70.0752	70.3284	71.5428	71.7747	72.8742	72.8742	73.0816	72.4468	71.7747	71.3072	70.8248	
alpha	5.6546	5.6717	5.6886	5.7695	5.7850	5.8583	5.8583	5.8721	5.8298	5.7850	5.7538	5.7217	
util living area	0.9988	0.9972	0.9931	0.9798	0.9359	0.8074	0.6284	0.6700	0.8854	0.9830	0.9972	0.9991 (86)	
MIT	19.9211	20.0531	20.2534	20.5194	20.7640	20.9370	20.9881	20.9830	20.8825	20.5698	20.2004	19.9040 (87)	
Th 2	20.0878	20.0908	20.0938	20.1078	20.1105	20.1227	20.1227	20.1250	20.1180	20.1105	20.1052	20.0996 (88)	
util rest of house	0.9983	0.9962	0.9906	0.9717	0.9078	0.7307	0.5128	0.5563	0.8283	0.9746	0.9961	0.9988 (89)	
MIT 2	19.0964	19.2305	19.4322	19.7059	19.9389	20.0907	20.1194	20.1197	20.0488	19.7592	19.3895	19.0891 (90)	
Living area fraction									fLA = Living area / (4) =			0.1036 (91)	
MIT	19.1818	19.3157	19.5173	19.7901	20.0243	20.1783	20.2093	20.2091	20.1351	19.8432	19.4735	19.1735 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.1818	19.3157	19.5173	19.7901	20.0243	20.1783	20.2093	20.2091	20.1351	19.8432	19.4735	19.1735 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9978	0.9951	0.9885	0.9679	0.9045	0.7361	0.5247	0.5679	0.8296	0.9712	0.9950	0.9984	(94)
Useful gains	425.5961	481.0496	514.0051	524.9378	496.3997	388.6781	265.8353	278.1616	396.1112	435.2930	413.2081	403.4712	(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	1157.5203	1117.1601	1005.1576	826.6306	629.8291	415.6947	268.9665	283.0455	452.3903	699.3490	942.3323	1148.1043	(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	544.5516	427.4662	365.4175	217.2188	99.2715	0.0000	0.0000	0.0000	0.0000	196.4576	380.9694	554.0071	(98)
Space heating												2785.3598	(98)
Space heating per m2												35.6184	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b													
Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	700.4837	551.4446	564.7418	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8591	0.9281	0.9140	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	601.8028	511.7913	516.1834	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	708.7010	681.8915	664.1444	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	76.9667	126.5546	110.0830	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												313.6043	(104)
												1.0000	(105)

$$fC = \text{cooled area} / (4) =$$

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	19.2417	31.6386	27.5207	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											78.4011 (107)
Space cooling per m2											1.0026 (108)
Energy for space heating											35.6184 (99)
Energy for space cooling											1.0026 (108)
Total											36.6210 (109)
Target Fabric Energy Efficiency (TFEE)											42.1 (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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.3300	
Infiltration rate											0.2165 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2003 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2203	0.2053	0.2053	0.1953	0.1953	0.1852	0.1852	0.1752	0.1752	0.1902	0.1852	0.1953 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6228 (39)
HLP	Jan 0.9159	Feb 0.9159	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9159 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (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	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
RHI water heating demand												1610.5098 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					3.3300	13.4839	0.7200	0.7000	0.7700		15.6828 (74)	
South					1.5300	56.7559	0.7200	0.7000	0.7700		30.3295 (78)	
South					3.8000	56.7559	0.7200	0.7000	0.7700		75.3283 (78)	
Solar gains	121.3406	172.5618	232.8058	287.4553	305.8830	334.6227	310.5061	295.0461	262.6894	201.2948	144.0453	98.8567 (83)
Total gains	672.7470	719.1082	757.5122	778.7127	763.1278	761.6660	720.1961	713.4429	700.6338	672.8979	652.7792	635.4545 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9059	0.8838	0.8373	0.7608	0.6343	0.4528	0.3212	0.3240	0.5317	0.7399	0.8623	0.9158 (86)
MIT	19.7701	19.9201	20.2118	20.5267	20.8020	20.9505	20.9878	20.9875	20.9134	20.6446	20.1778	19.7209 (87)
Th 2	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.8939	0.8694	0.8168	0.7299	0.5858	0.3857	0.2417	0.2440	0.4661	0.7004	0.8426	0.9048 (89)
MIT 2	18.5390	18.7505	19.1595	19.5905	19.9477	20.1154	20.1481	20.1479	20.0793	19.7543	19.1190	18.4706 (90)
Living area fraction	18.6665	18.8716	19.2685	19.6875	20.0362	20.2019	20.2351	20.2349	20.1657	19.8465	19.2287	18.6001 (91)
MIT	18.6665	18.8716	19.2685	19.6875	20.0362	20.2019	20.2351	20.2349	20.1657	19.8465	19.2287	18.6001 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5165	18.7216	19.1185	19.5375	19.8862	20.0519	20.0851	20.0849	20.0157	19.6965	19.0787	18.4501 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	581.9532	603.8392	596.6191	548.8179	434.4468	287.3811	169.3240	169.2718	318.6322	455.2297	530.4426	556.9773 (95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	939.4424	918.3197	824.9895	683.1034	486.0474	297.3707	170.8245	170.8120	337.7485	551.2442	764.8384	927.5205 (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	265.9720	211.3309	169.9076	96.6855	38.3909	0.0000	0.0000	0.0000	0.0000	71.4348	168.7649	275.6842 (98)
Space heating												1298.1707 (98)
RHI space heating demand												1298 (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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.3300
Infiltration rate												0.2165 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2003 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2553	0.2503	0.2453	0.2203	0.2153	0.1902	0.1902	0.1852	0.2003	0.2153	0.2253	0.2353 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5053	0.5003	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.1233	Feb 32.7951	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	71.9725	71.6443	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6537 (39)
HLP	Jan 0.9204	Feb 0.9162	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9163 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)										Total = Sum (45)m =		1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (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	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)
										Total per year (kWh/year) = Sum (64)m =		1610.5098 (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	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				3.3300	10.6334	0.7200	0.7000	0.7700		12.3674 (74)		
South				1.5300	46.7521	0.7200	0.7000	0.7700		24.9837 (78)		
South				3.8000	46.7521	0.7200	0.7000	0.7700		62.0509 (78)		

Solar gains	99.4020	166.1750	221.7322	269.7239	300.7463	298.8270	287.9316	264.1817	237.9592	181.8771	118.4225	85.5160 (83)
Total gains	650.8083	712.7215	746.4386	760.9813	757.9911	725.8703	697.6216	682.5786	675.9035	653.4802	627.1564	622.1137 (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	31.4120	31.5559	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.0941	3.1037	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9252	0.9004	0.8641	0.8031	0.7055	0.5657	0.4299	0.4553	0.6284	0.8034	0.8963	0.9332 (86)
MIT	19.5499	19.7609	20.0469	20.3813	20.6819	20.8843	20.9631	20.9547	20.8317	20.4675	19.9503	19.4921 (87)
Th 2	20.1502	20.1538	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.9159	0.8884	0.8473	0.7777	0.6660	0.5062	0.3546	0.3804	0.5724	0.7735	0.8817	0.9248 (89)
MIT 2	18.2214	18.5235	18.9285	19.3941	19.7968	20.0463	20.1285	20.1212	19.9882	19.5197	18.7992	18.1417 (90)
Living area fraction	18.3590	18.6517	19.0444	19.4963	19.8885	20.1331	20.2150	20.2076	20.0756	19.6179	18.9184	18.2816 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2090	18.5017	18.8944	19.3463	19.7385	19.9831	20.0650	20.0576	19.9256	19.4679	18.7684	18.1316 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	578.2859	612.4307	610.1935	570.6674	488.6135	358.1541	241.6150	253.5428	375.8050	487.1619	534.4214	558.9965 (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	1001.0663	974.4851	887.7196	748.1938	575.7380	385.5535	248.1712	261.9656	417.2463	635.1444	835.7234	997.8204 (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	314.5486	243.3006	206.4794	127.8190	64.8207	0.0000	0.0000	0.0000	0.0000	110.0990	216.9374	326.4850 (98)
Space heating												1610.4897 (98)
Space heating per m2										(98) / (4) =		20.5945 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1779.5466 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	314.5486	243.3006	206.4794	127.8190	64.8207	0.0000	0.0000	0.0000	0.0000	110.0990	216.9374	326.4850	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	347.5675	268.8404	228.1541	141.2365	71.6251	0.0000	0.0000	0.0000	0.0000	121.6563	239.7098	360.7569	(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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261	(64)
Efficiency of water heater	89.3774	89.2843	89.1290	88.8487	88.3550	87.3000	87.3000	87.3000	87.3000	88.7005	89.1783	87.3000	(216)
Fuel for water heating, kWh/month	183.4532	161.0483	167.5124	147.9756	143.8802	127.3000	119.5890	134.9162	135.8416	153.8406	165.1324	178.0546	(219)
Water heating fuel used												1818.5440	(219)
Annual totals kWh/year													
Space heating fuel - main system												1779.5466	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													130.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.32 * 1068 * 1.00) =										-273.4260			-273.4260 (233)
Total delivered energy for all uses													3838.5097 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1779.5466	3.4800	61.9282 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1818.5440	3.4800	63.2853 (247)
Mechanical ventilation fans	55.2921	13.1900	7.2930 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	383.5529	13.1900	50.5906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-273.4260	13.1900	-36.0649 (252)
Total energy cost			276.9248 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4200 (256)
SAP value		0.9441 (257)
SAP rating (Section 12)		86.8303
SAP band		87 (258)
		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	1779.5466	0.2160	384.3821 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1818.5440	0.2160	392.8055 (264)
Space and water heating			777.1876 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-273.4260	0.5190	-141.9081 (269)
Total kg/year			901.9650 (272)
CO2 emissions per m2			11.5300 (273)
EI value			90.1897
EI rating			90 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8846 = 3.934$, stars = 4
Water heating environmental impact	$0.216 / 0.8846 = 0.2442$, 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	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.3300	
Infiltration rate											0.2165 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2003 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.2203	0.2053	0.2053	0.1953	0.1953	0.1852	0.1852	0.1752	0.1752	0.1902	0.1852	0.1953 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6228 (39)
HLP	Jan 0.9159	Feb 0.9159	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9159 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												1445.3269 (45)
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (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	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)
Total per year (kWh/year) = Sum(64)m =												1610.5098 (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	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North						3.3300	13.4839	0.7200	0.7000	0.7700		15.6828 (74)
South						1.5300	56.7559	0.7200	0.7000	0.7700		30.3295 (78)
South						3.8000	56.7559	0.7200	0.7000	0.7700		75.3283 (78)

Solar gains	121.3406	172.5618	232.8058	287.4553	305.8830	334.6227	310.5061	295.0461	262.6894	201.2948	144.0453	98.8567 (83)
Total gains	672.7470	719.1082	757.5122	778.7127	763.1278	761.6660	720.1961	713.4429	700.6338	672.8979	652.7792	635.4545 (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	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	
alpha	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	
util living area	0.9059	0.8838	0.8373	0.7608	0.6343	0.4528	0.3212	0.3240	0.5317	0.7399	0.8623	0.9158 (86)	
MIT	19.7701	19.9201	20.2118	20.5267	20.8020	20.9505	20.9878	20.9875	20.9134	20.6446	20.1778	19.7209 (87)	
Th 2	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)	
util rest of house	0.8939	0.8694	0.8168	0.7299	0.5858	0.3857	0.2417	0.2440	0.4661	0.7004	0.8426	0.9048 (89)	
MIT 2	18.5390	18.7505	19.1595	19.5905	19.9477	20.1154	20.1481	20.1479	20.0793	19.7543	19.1190	18.4706 (90)	
Living area fraction									fLA = Living area / (4) =				0.1036 (91)
MIT	18.6665	18.8716	19.2685	19.6875	20.0362	20.2019	20.2351	20.2349	20.1657	19.8465	19.2287	18.6001 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.5165	18.7216	19.1185	19.5375	19.8862	20.0519	20.0851	20.0849	20.0157	19.6965	19.0787	18.4501 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8650	0.8397	0.7876	0.7048	0.5693	0.3773	0.2351	0.2373	0.4548	0.6765	0.8126	0.8765 (94)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000 (96)
Heat loss rate W	939.4424	918.3197	824.9895	683.1034	486.0474	297.3707	170.8245	170.8120	337.7485	551.2442	764.8384	927.5205 (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	265.9720	211.3309	169.9076	96.6855	38.3909	0.0000	0.0000	0.0000	0.0000	71.4348	168.7649	275.6842 (98)
Space heating												1298.1707 (98)
Space heating per m2										(98) / (4) =		16.6006 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1434.4427 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	265.9720	211.3309	169.9076	96.6855	38.3909	0.0000	0.0000	0.0000	0.0000	71.4348	168.7649	275.6842	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	293.8917	233.5148	187.7432	106.8348	42.4208	0.0000	0.0000	0.0000	0.0000	78.9334	186.4806	304.6234	(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	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261	(64)
Efficiency of water heater (217)m	89.2523	89.1765	88.9746	88.6280	88.0219	87.3000	87.3000	87.3000	87.3000	88.3737	88.9802	87.3000	(216)
Fuel for water heating, kWh/month	183.7103	161.2431	167.8032	148.3440	144.4247	127.3000	119.5890	134.9162	135.8416	154.4095	165.5000	178.3015	(219)
Water heating fuel used												1821.3831	(219)
Annual totals kWh/year													
Space heating fuel - main system												1434.4427	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													130.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.32 * 1179 * 1.00) =										-301.8437			-301.8437 (233)
Total delivered energy for all uses													3467.8272 (238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1434.4427	3.7400	53.6482 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1821.3831	3.7400	68.1197 (247)
Mechanical ventilation fans	55.2921	20.4300	11.2962 (249)
Pumps and fans for heating	75.0000	20.4300	15.3225 (249)
Energy for lighting	383.5529	20.4300	78.3599 (250)
Additional standing charges			95.0000 (251)
Energy saving/generation technologies			
PV Unit	-301.8437	20.4300	-61.6667 (252)
Total energy cost			260.0798 (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	1434.4427	0.2160	309.8396 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1821.3831	0.2160	393.4188 (264)
Space and water heating			703.2584 (265)
Pumps and fans	130.2921	0.5190	67.6216 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-301.8437	0.5190	-156.6569 (269)
Total kg/year			813.2871 (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	1434.4427	1.2200	1750.0201 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1821.3831	1.2200	2222.0874 (264)
Space and water heating			3972.1075 (265)
Pumps and fans	130.2921	3.0700	399.9969 (267)
Energy for lighting	383.5529	3.0700	1177.5074 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Energy saving/generation technologies
 PV Unit -301.8437 3.0700 -926.6602 (269)
 Primary energy kWh/year 4622.9516 (272)
 Primary energy kWh/m2/year 59.1170 (273)

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.3	-£ 26	-184 kg (22.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£26 2.36 kg/m²	B 88	A 92
Total Savings	£26 2.36 kg/m²		

Potential energy efficiency rating: B 88
 Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 505 TEST (31 Aug 2022)
 Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£105	£115	-£10
Mains gas	£217	£180	£36
Space heating	£175	£175	£0
Water heating	£68	£42	£26
Lighting	£78	£78	£0
Generated (PV)	-£62	-£62	£0
Total cost of fuels	£260	£233	£26
Total cost of uses	£259	£233	£26
Delivered energy	44 kWh/m²	33 kWh/m²	12 kWh/m²
Carbon dioxide emissions	0.8 tonnes	0.6 tonnes	0.2 tonnes
CO2 emissions per m²	10 kg/m²	8 kg/m²	2 kg/m²
Primary energy	59 kWh/m²	46 kWh/m²	13 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.3300
Infiltration rate												0.2165 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2003 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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												
	0.2553	0.2503	0.2453	0.2203	0.2153	0.1902	0.1902	0.1852	0.2003	0.2153	0.2253	0.2353 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5053	0.5003	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.1233	Feb 32.7951	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	71.9725	71.6443	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6537 (39)
HLP	Jan 0.9204	Feb 0.9162	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9163 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (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	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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												1.2548 (H8)
Utilisation factor												0.5493 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-840.4246 (H17)
Solar input	-24.3706	-40.6676	-69.2616	-92.8241	-114.6764	-112.7452	-111.2552	-97.2042	-76.1304	-51.9881	-28.9071	-20.3941 (63)
Solar input (sum of months) = Sum (63)m =												-840.4246 (63)
Output from w/h	139.5950	103.1233	80.0406	38.6502	12.4490	0.0000	0.0000	20.5776	42.4593	84.4693	118.3551	138.8320 (64)
Total per year (kWh/year) = Sum (64)m =												778.5514 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				3.3300	10.6334		0.7200		0.7000		0.7700		12.3674 (74)
South				1.5300	46.7521		0.7200		0.7000		0.7700		24.9837 (78)
South				3.8000	46.7521		0.7200		0.7000		0.7700		62.0509 (78)
Solar gains	99.4020	166.1750	221.7322	269.7239	300.7463	298.8270	287.9316	264.1817	237.9592	181.8771	118.4225		85.5160 (83)
Total gains	650.8083	712.7215	746.4386	760.9813	757.9911	725.8703	697.6216	682.5786	675.9035	653.4802	627.1564		622.1137 (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	31.4120	31.5559	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	
alpha	3.0941	3.1037	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	
util living area	0.9252	0.9004	0.8641	0.8031	0.7055	0.5657	0.4299	0.4553	0.6284	0.8034	0.8963	0.9332 (86)	
MIT	19.5499	19.7609	20.0469	20.3813	20.6819	20.8843	20.9631	20.9547	20.8317	20.4675	19.9503	19.4921 (87)	
Th 2	20.1502	20.1538	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)	
util rest of house	0.9159	0.8884	0.8473	0.7777	0.6660	0.5062	0.3546	0.3804	0.5724	0.7735	0.8817	0.9248 (89)	
MIT 2	18.2214	18.5235	18.9285	19.3941	19.7968	20.0463	20.1285	20.1212	19.9882	19.5197	18.7992	18.1417 (90)	
Living area fraction													fIA = Living area / (4) =
MIT	18.3590	18.6517	19.0444	19.4963	19.8885	20.1331	20.2150	20.2076	20.0756	19.6179	18.9184	18.2816 (92)	0.1036 (91)
Temperature adjustment													-0.1500
adjusted MIT	18.2090	18.5017	18.8944	19.3463	19.7385	19.9831	20.0650	20.0576	19.9256	19.4679	18.7684	18.1316 (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	0.8886	0.8593	0.8175	0.7499	0.6446	0.4934	0.3463	0.3714	0.5560	0.7455	0.8521	0.8985	(94)
Useful gains	578.2859	612.4307	610.1935	570.6674	488.6135	358.1541	241.6150	253.5428	375.8050	487.1619	534.4214	558.9965	(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	1001.0663	974.4851	887.7196	748.1938	575.7380	385.5535	248.1712	261.9656	417.2463	635.1444	835.7234	997.8204	(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	314.5486	243.3006	206.4794	127.8190	64.8207	0.0000	0.0000	0.0000	0.0000	110.0990	216.9374	326.4850	(98)
Space heating												1610.4897	(98)
Space heating per m2												20.5945	(99)

(98) / (4) =

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1779.5466 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	314.5486	243.3006	206.4794	127.8190	64.8207	0.0000	0.0000	0.0000	0.0000	110.0990	216.9374	326.4850	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	347.5675	268.8404	228.1541	141.2365	71.6251	0.0000	0.0000	0.0000	0.0000	121.6563	239.7098	360.7569	(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	139.5950	103.1233	80.0406	38.6502	12.4490	0.0000	0.0000	20.5776	42.4593	84.4693	118.3551	138.8320	(64)
Efficiency of water heater (217)m	89.4917	89.5232	89.5827	89.7363	89.9687	87.3000	87.3000	87.3000	87.3000	89.0824	89.3440	87.3000	(216)
Fuel for water heating, kWh/month	155.9866	115.1917	89.3483	43.0709	13.8370	0.0000	0.0000	23.5711	48.6361	94.8216	132.4713	155.0832	(219)
Water heating fuel used												872.0178	(219)
Annual totals kWh/year													
Space heating fuel - main system												1779.5466	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
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													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.32 * 1068 * 1.00) =										-273.4260		-273.4260	(233)
Total delivered energy for all uses												2941.9834	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1779.5466	3.4800	61.9282 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	872.0178	3.4800	30.3462 (247)
Mechanical ventilation fans	55.2921	13.1900	7.2930 (249)
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	383.5529	13.1900	50.5906 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-273.4260	13.1900	-36.0649 (252)
Total energy cost			250.5807 (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] =	0.8543 (257)
SAP value		88.0832
SAP rating (Section 12)		88 (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	1779.5466	0.2160	384.3821 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	872.0178	0.2160	188.3558 (264)
Space and water heating			572.7379 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-273.4260	0.5190	-141.9081 (269)
Total kg/year			723.4654 (272)
CO2 emissions per m2			9.2500 (273)
EI value			92.1311
EI rating			92 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	39.1000 (1b)	x 2.4100 (2b)	= 94.2310 (1b) - (3b)
First floor	39.1000 (1c)	x 2.6700 (2c)	= 104.3970 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 198.6280 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (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) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50											4.3300	
Infiltration rate											0.2165 (18)	
Number of sides sheltered											1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2003 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.4000	4.1000	4.1000	3.9000	3.9000	3.7000	3.7000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.1000	1.0250	1.0250	0.9750	0.9750	0.9250	0.9250	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate												
	0.2203	0.2053	0.2053	0.1953	0.1953	0.1852	0.1852	0.1752	0.1752	0.1902	0.1852	0.1953 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (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			2.1200	1.3000	2.7560		(26)					
Window (Uw = 1.40)			4.8600	1.3258	6.4432		(27)					
French Door (Uw = 1.40)			3.8000	1.3258	5.0379		(27)					
150mm EPS B&B			39.1000	0.1500	5.8650	75.0000	2932.5000 (28a)					
140mm Timber Frame	42.1600	10.7800	31.3800	0.1900	5.9622	9.0000	282.4200 (29a)					
400mm Mineral Wool	39.1000		39.1000	0.1100	4.3010	9.0000	351.9000 (30)					
Total net area of external elements Aum(A, m2)			120.3600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	30.3653		(33)					
Timebr Frame			95.9200	0.0000	0.0000	20.0000	1918.4000 (32)					
Timber GF			62.6100			9.0000	563.4900 (32c)					
Timber FF			75.8400			9.0000	682.5600 (32c)					
Internal Floor			39.1000			18.0000	703.8000 (32d)					
Internal Ceiling			39.1000			18.0000	703.8000 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	8138.8700 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							104.0776 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.4839 (36)					
Total fabric heat loss						(33) + (36) =	38.8492 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 32.7736	Feb 32.7736	Mar 32.7736	Apr 32.7736	May 32.7736	Jun 32.7736	Jul 32.7736	Aug 32.7736	Sep 32.7736	Oct 32.7736	Nov 32.7736	Dec 32.7736 (38)
Heat transfer coeff	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228	71.6228 (39)
Average = Sum(39)m / 12 =												71.6228 (39)
HLP	Jan 0.9159	Feb 0.9159	Mar 0.9159	Apr 0.9159	May 0.9159	Jun 0.9159	Jul 0.9159	Aug 0.9159	Sep 0.9159	Oct 0.9159	Nov 0.9159	Dec 0.9159 (40)
HLP (average)												0.9159 (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												2.4278 (42)
Average daily hot water use (litres/day)												91.8607 (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	101.0468	97.3724	93.6979	90.0235	86.3491	82.6747	82.6747	86.3491	90.0235	93.6979	97.3724	101.0468 (44)
Energy conte	149.8495	131.0593	135.2415	117.9068	113.1344	97.6264	90.4652	103.8101	105.0499	122.4256	133.6371	145.1212 (45)
Energy content (annual)												
Distribution loss (46)m = 0.15 x (45)m	22.4774	19.6589	20.2862	17.6860	16.9702	14.6440	13.5698	15.5715	15.7575	18.3638	20.0456	21.7682 (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	14.1162	12.7316	14.0607	13.5675	13.9910	13.5065	13.9361	13.9717	13.5398	14.0319	13.6251	14.1049 (61)
Total heat required for water heating calculated for each month	163.9657	143.7909	149.3022	131.4743	127.1254	111.1329	104.4012	117.7818	118.5897	136.4574	147.2622	159.2261 (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												1200.5924 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2016.9953 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.3955 (H8)
Utilisation factor												0.5116 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												91.8607 (H14)
Volume ratio Veff/V												0.8165 (H15)
Solar storage volume factor												0.9594 (H16)
Solar input												-870.5009 (H17)
Solar input	-28.5766	-40.6341	-69.8403	-94.2308	-110.1318	-118.7419	-113.0330	-103.0222	-80.5017	-55.3617	-33.7986	-22.6280 (63)
Solar input (sum of months) = Sum (63)m =												-870.5009 (63)
Output from w/h	135.3891	103.1567	79.4618	37.2436	16.9936	0.0000	0.0000	14.7596	38.0880	81.0957	113.4636	136.5981 (64)
Total per year (kWh/year) = Sum (64)m =												756.2498 (64)
Heat gains from water heating, kWh/month	53.3540	46.7601	48.4830	42.5959	41.1149	35.8374	33.5637	38.0098	38.3140	44.2145	47.8406	51.7790 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692	145.6692 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.2959	48.2251	39.2193	29.6915	22.1948	18.7378	20.2468	26.3176	35.3234	44.8512	52.3479	55.8049 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	321.8469	325.1867	316.7706	298.8537	276.2369	254.9803	240.7795	237.4398	245.8559	263.7727	286.3896	307.6462 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947	51.9947 (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)	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128	-97.1128 (71)
Water heating gains (Table 5)	71.7124	69.5835	65.1653	59.1610	55.2620	49.7742	45.1125	51.0884	53.2140	59.4281	66.4453	69.5955 (72)
Total internal gains	551.4063	546.5465	524.7063	491.2574	457.2448	427.0433	409.6900	418.3969	437.9443	471.6031	508.7339	536.5977 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				3.3300	13.4839	0.7200	0.7000	0.7700	15.6828 (74)			
South				1.5300	56.7559	0.7200	0.7000	0.7700	30.3295 (78)			
South				3.8000	56.7559	0.7200	0.7000	0.7700	75.3283 (78)			
Solar gains	121.3406	172.5618	232.8058	287.4553	305.8830	334.6227	310.5061	295.0461	262.6894	201.2948	144.0453	98.8567 (83)
Total gains	672.7470	719.1082	757.5122	778.7127	763.1278	761.6660	720.1961	713.4429	700.6338	672.8979	652.7792	635.4545 (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	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653	31.5653
alpha	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044	3.1044
util living area	0.9059	0.8838	0.8373	0.7608	0.6343	0.4528	0.3212	0.3240	0.5317	0.7399	0.8623	0.9158 (86)
MIT	19.7701	19.9201	20.2118	20.5267	20.8020	20.9505	20.9878	20.9875	20.9134	20.6446	20.1778	19.7209 (87)
Th 2	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540	20.1540 (88)
util rest of house	0.8939	0.8694	0.8168	0.7299	0.5858	0.3857	0.2417	0.2440	0.4661	0.7004	0.8426	0.9048 (89)
MIT 2	18.5390	18.7505	19.1595	19.5905	19.9477	20.1154	20.1481	20.1479	20.0793	19.7543	19.1190	18.4706 (90)
Living area fraction	18.6665	18.8716	19.2685	19.6875	20.0362	20.2019	20.2351	20.2349	20.1657	19.8465	19.2287	18.6001 (92)
MIT	18.5165	18.7216	19.1185	19.5375	19.8862	20.0519	20.0851	20.0849	20.0157	19.6965	19.0787	18.4501 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.4501 (93)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8650	0.8397	0.7876	0.7048	0.5693	0.3773	0.2351	0.2373	0.4548	0.6765	0.8126	0.8765	(94)
Useful gains	581.9532	603.8392	596.6191	548.8179	434.4468	287.3811	169.3240	169.2718	318.6322	455.2297	530.4426	556.9773	(95)
Ext temp.	5.4000	5.9000	7.6000	10.0000	13.1000	15.9000	17.7000	17.7000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	939.4424	918.3197	824.9895	683.1034	486.0474	297.3707	170.8245	170.8120	337.7485	551.2442	764.8384	927.5205	(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	265.9720	211.3309	169.9076	96.6855	38.3909	0.0000	0.0000	0.0000	0.0000	71.4348	168.7649	275.6842	(98)
Space heating												1298.1707	(98)
Space heating per m2												16.6006	(99)
												(98) / (4) =	

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1434.4427 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	265.9720	211.3309	169.9076	96.6855	38.3909	0.0000	0.0000	0.0000	0.0000	71.4348	168.7649	275.6842	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	293.8917	233.5148	187.7432	106.8348	42.4208	0.0000	0.0000	0.0000	0.0000	78.9334	186.4806	304.6234	(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	135.3891	103.1567	79.4618	37.2436	16.9936	0.0000	0.0000	14.7596	38.0880	81.0957	113.4636	136.5981	(64)
Efficiency of water heater (217)m	89.3947	89.4248	89.4551	89.5868	89.4935	87.3000	87.3000	87.3000	87.3000	88.7700	89.1857	87.3000	(216)
Fuel for water heating, kWh/month	151.4509	115.3558	88.8287	41.5726	18.9886	0.0000	0.0000	16.9068	43.6289	91.3549	127.2217	152.7702	(219)
Water heating fuel used												848.0791	(219)
Annual totals kWh/year													
Space heating fuel - main system												1434.4427	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEVDecentralised, Database: total watage = 6.6170, total flow = 29.0000, SFP = 0.2282)													
mechanical ventilation fans (SFP = 0.2282)													55.2921 (230a)
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													180.2921 (231)
Electricity for lighting (calculated in Appendix L)													383.5529 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 0.32 * 1179 * 1.00) =										-301.8437		-301.8437	(233)
Total delivered energy for all uses												2544.5231	(238)

10a. Fuel costs - using BEDF prices (505)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1434.4427	3.7400	53.6482	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	848.0791	3.7400	31.7182	(247)
Mechanical ventilation fans	55.2921	20.4300	11.2962	(249)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Pump for solar water heating	50.0000	20.4300	10.2150	(249)
Energy for lighting	383.5529	20.4300	78.3599	(250)
Additional standing charges			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-301.8437	20.4300	-61.6667	(252)
Total energy cost			233.8932	(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	1434.4427	0.2160	309.8396	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	848.0791	0.2160	183.1851	(264)

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Space and water heating			493.0247 (265)
Pumps and fans	180.2921	0.5190	93.5716 (267)
Energy for lighting	383.5529	0.5190	199.0640 (268)
Energy saving/generation technologies			
PV Unit	-301.8437	0.5190	-156.6569 (269)
Total kg/year			629.0034 (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	1434.4427	1.2200	1750.0201 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	848.0791	1.2200	1034.6564 (264)
Space and water heating			2784.6766 (265)
Pumps and fans	180.2921	3.0700	553.4969 (267)
Energy for lighting	383.5529	3.0700	1177.5074 (268)
Energy saving/generation technologies			
PV Unit	-301.8437	3.0700	-926.6602 (269)
Primary energy kWh/year			3589.0207 (272)
Primary energy kWh/m2/year			45.8954 (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	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	104.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	262.19 (P1)
Transmission heat loss coefficient	38.85 (37)
Summer heat loss coefficient	301.04 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
South	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.3300	81.1852	0.7200	0.7000	0.9000	110.3663
South	1.5300	112.2060	0.7200	0.7000	0.9000	70.0847
South	3.8000	112.2060	0.7200	0.7000	0.9000	174.0665

total: 354.5175

	Jun	Jul	Aug	
Solar gains	372	355	331	(P3)
Internal gains	424	407	415	
Total summer gains	797	761	746	(P5)

Summer gain/loss ratio	2.65	2.53	2.48	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 104.1)	1.27	1.27	1.27	
Threshold temperature	19.92	21.70	21.55	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight