

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X520 Det				Issued on Date	15/12/2022
Assessment Reference	X520 Det	Prop Type Ref	Lime			
Property	5 Bed, K, WC, U, B, 3En					
SAP Rating		87 B	DER	12.60	TER	14.79
Environmental		87 B	% DER<TER	14.81		
CO ₂ Emissions (t/year)		2.05	DFEE	43.08	TFEE	56.15
General Requirements Compliance		Pass	% DFEE<TFEE	23.28		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk				Assessor ID	Q920-0001
Client						

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

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DWELLING AS DESIGNED

Detached House, total floor area 192 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) 14.79 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.60 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)43.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.14 (max. 0.35)	OK
Openings	1.22 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 4.01 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC HEAT H18

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation

Hot water storage Measured cylinder loss: 1.76 kWh/day
Permitted by DBSCG 2.56 OK
Primary pipework insulated: Yes OK

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

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): Medium OK

Based on:

Overshading:
Average
Windows facing North East: 6.01 m², No overhang
Windows facing South East: 15.73 m², No overhang
Windows facing South West: 3.67 m², No overhang
Windows facing North West: 14.21 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 0.09 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.022 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (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	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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 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
Window (Uw = 1.20)			32.2700	1.1450	36.9504		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			96.9700	0.1100	10.6667	75.0000	7272.7500 (28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.2500	41.4075	52.8000	8745.2640 (29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.0900	8.5149	9.0000	851.4900 (30)
Bay Plane	2.3600		2.3600	0.1400	0.3304	9.0000	21.2400 (31)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.7642		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			94.6100			13.8000	1305.6180 (32d)
Internal Ceiling			94.6100			9.0000	851.4900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25453.4520 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							132.8607 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6372 (36)
Total fabric heat loss						(33) + (36) =	118.4014 (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	82.3015	81.4857	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839 (38)
Heat transfer coeff	200.7029	199.8871	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853 (39)
Average = Sum(39)m / 12 =												199.8703 (39)
HLP	1.0476	1.0434	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428 (40)
HLP (average)												1.0433 (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	2.9910 (42)
Average daily hot water use (litres/day)	105.2352 (43)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587	(44)
Energy content (annual)	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	120.3447	140.2501	153.0940	166.2501	(45)
Distribution loss (46)m = 0.15 x (45)m	25.7500	22.5211	23.2398	20.2610	19.4409	16.7760	15.5455	17.8387	18.0517	21.0375	22.9641	24.9375	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9504 (55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	224.3916	197.7633	207.6567	186.0974	182.3310	162.8643	156.3613	171.6491	171.3687	192.9749	204.1180	218.9749	(62)
WWHRS	-43.5233	-38.2968	-39.0858	-32.1458	-29.8414	-24.6130	-20.8223	-25.2138	-25.9532	-32.0925	-37.1874	-42.0701	eq. (G10)
Total of WWHRS savings	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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049	(64)
Heat gains from water heating, kWh/month	99.2591	88.0198	93.6947	85.7311	85.2739	78.0061	76.6390	81.7222	80.8338	88.8130	91.7229	97.4580	(65)
Total per year (kWh/year) = Sum (64)m =													1885.7059 (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	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4857	28.8535	23.4652	17.7647	13.2793	11.2110	12.1138	15.7460	21.1343	26.8348	31.3202	33.3885	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.9712	366.7377	357.2462	337.0400	311.5333	287.5605	271.5453	267.7788	277.2703	297.4765	322.9832	346.9559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	(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)	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	(71)
Water heating gains (Table 5)	133.4127	130.9818	125.9338	119.0710	114.6154	108.3418	103.0094	109.8416	112.2692	119.3723	127.3930	130.9920	(72)
Total internal gains	599.7339	597.4373	577.5095	544.7400	510.2923	477.9776	457.5328	464.2308	481.5380	514.5479	552.5607	582.2007	(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	
Northeast	6.0100	11.2829	0.4600	0.0000	0.7700	24.0185	(75)
Southeast	8.3800	36.7938	0.4600	0.0000	0.7700	109.2113	(77)
Southwest	3.6700	36.7938	0.4600	0.0000	0.7700	47.8288	(79)
Northwest	14.2100	11.2829	0.4600	0.0000	0.7700	56.7891	(81)
Southeast	7.3500	36.7938	0.4300	0.0000	0.7700	89.5409	(77)

Solar gains	327.3886	584.5049	871.0397	1198.7609	1451.7866	1489.2663	1415.8453	1219.7417	983.3747	665.2253	397.0241	277.0135	(83)
Total gains	927.1225	1181.9422	1448.5492	1743.5009	1962.0790	1967.2439	1873.3781	1683.9725	1464.9127	1179.7732	949.5848	859.2142	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

Utilisation factor for gains for living area, nil,m (see Table 9a)													21.0000 (85)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	35.2282	35.3720	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	
alpha	3.3485	3.3581	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	
util living area	0.9902	0.9778	0.9488	0.8775	0.7492	0.5868	0.4489	0.5108	0.7467	0.9295	0.9819	0.9923	(86)
MIT	19.0472	19.3430	19.7766	20.2869	20.6882	20.9002	20.9694	20.9528	20.7712	20.2115	19.5178	18.9881	(87)
Th 2	20.0438	20.0474	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	(88)
util rest of house	0.9883	0.9737	0.9391	0.8546	0.7045	0.5166	0.3595	0.4177	0.6844	0.9112	0.9779	0.9909	(89)
MIT 2	17.4071	17.8387	18.4633	19.1802	19.7118	19.9630	20.0298	20.0178	19.8293	19.0916	18.0962	17.3235	(90)
Living area fraction									fLA = Living area / (4) =				0.1149 (91)
MIT	17.5956	18.0115	18.6142	19.3073	19.8240	20.0707	20.1377	20.1252	19.9375	19.2202	18.2596	17.5147	(92)
Temperature adjustment													-0.1500
adjusted MIT	17.4456	17.8615	18.4642	19.1573	19.6740	19.9207	19.9877	19.9752	19.7875	19.0702	18.1096	17.3647	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9802	0.9597	0.9175	0.8285	0.6849	0.5066	0.3536	0.4101	0.6650	0.8863	0.9653	0.9842	(94)
Useful gains	908.8060	1134.3131	1328.9793	1444.5070	1343.7342	996.6742	662.5087	690.6554	974.1197	1045.5789	916.6302	845.6176	(95)

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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	2638.3519	2590.8427	2390.2642	2049.2598	1593.0817	1062.9970	676.8175	714.2811	1136.2843	1692.2278	2199.5474	2630.1178 (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	1286.7821	978.7879	789.5960	435.4220	185.5146	0.0000	0.0000	0.0000	0.0000	481.1068	923.7004	1327.6682 (98)
Space heating												6408.5779 (98)
Space heating per m2											(98) / (4) =	33.4512 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												7073.4855 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1286.7821	978.7879	789.5960	435.4220	185.5146	0.0000	0.0000	0.0000	0.0000	481.1068	923.7004	1327.6682 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1420.2893	1080.3399	871.5187	480.5982	204.7622	0.0000	0.0000	0.0000	0.0000	531.0229	1019.5368	1465.4174 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049 (64)
Efficiency of water heater	89.1291	88.9315	88.5146	87.5379	85.4381	79.9000	79.9000	79.9000	79.9000	87.6582	88.7803	79.9000 (216)
Fuel for water heating, kWh/month	202.9286	179.3138	190.4442	175.8686	178.4795	173.0304	169.6358	183.2732	181.9968	183.5338	188.0267	198.3337 (219)
Water heating fuel used												2204.8653 (219)
Annual totals kWh/year												
Space heating fuel - main system												7073.4855 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 14.1050, total flow = 61.0000, SFP = 0.2312)												
mechanical ventilation fans (SFP = 0.2312)												139.1418 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												214.1418 (231)
Electricity for lighting (calculated in Appendix L)												573.7068 (232)
Total delivered energy for all uses												10066.1994 (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	7073.4855	0.2160	1527.8729 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2204.8653	0.2160	476.2509 (264)
Space and water heating			2004.1238 (265)
Pumps and fans	214.1418	0.5190	111.1396 (267)
Energy for lighting	573.7068	0.5190	297.7538 (268)
Total CO2, kg/year			2413.0172 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.6000 (273)

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

DER		12.6000 ZC1
Total Floor Area		191.5800
Assumed number of occupants	TFA	2.9910
CO2 emission factor in Table 12 for electricity displaced from grid	N	0.5190
CO2 emissions from appliances, equation (L14)	EF	11.2271 ZC2
CO2 emissions from cooking, equation (L16)		0.9958 ZC3
Total CO2 emissions		24.8230 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		24.8230 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.0811 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3311 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3311 (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	0.4221	0.4139	0.4056	0.3642	0.3559	0.3145	0.3145	0.3063	0.3311	0.3559	0.3725	0.3890 (22b)
Effective ac	0.5891	0.5856	0.5823	0.5663	0.5633	0.5495	0.5495	0.5469	0.5548	0.5633	0.5694	0.5757 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			39.6200	1.3258	52.5265		(27)
FP McCann System			96.9700	0.1300	12.6061		(28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.1800	29.8134		(29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.1300	12.2993		(30)
Bay Plane	2.3600		2.3600	0.1300	0.3068		(30)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	109.7021	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8005 (36)
Total fabric heat loss						(33) + (36) =	126.5026 (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	95.8873	95.3241	94.7721	92.1792	91.6941	89.4358	89.4358	89.0176	90.3057	91.6941	92.6755	93.7015 (38)
Heat transfer coeff	222.3899	221.8268	221.2747	218.6818	218.1967	215.9384	215.9384	215.5202	216.8083	218.1967	219.1781	220.2041 (39)
Average = Sum(39)m / 12 =												218.6795 (39)
HLP	1.1608	1.1579	1.1550	1.1415	1.1389	1.1271	1.1271	1.1250	1.1317	1.1389	1.1441	1.1494 (40)
HLP (average)												1.1415 (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												2.9910 (42)
Average daily hot water use (litres/day)												105.2352 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587 (44)
Energy content (annual)	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	120.3447	140.2501	153.0940	166.2501 (45)
Distribution loss (46)m = 0.15 x (45)m	25.7500	22.5211	23.2398	20.2610	19.4409	16.7760	15.5455	17.8387	18.0517	21.0375	22.9641	24.9375 (46)
Water storage loss:												250.0000 (47)
Store volume												1.8903 (48)
a) If manufacturer declared loss factor is known (kWh/day):												

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												1.0208 (55)
Total storage loss												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(56)
If cylinder contains dedicated solar storage												
31.6444	28.5820	31.6444	30.6236	31.6444	30.6236	31.6444	31.6444	30.6236	31.6444	30.6236	31.6444	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month												
226.5736	199.7341	209.8387	188.2090	184.5130	164.9759	158.5432	173.8311	173.4803	195.1569	206.2296	221.1569	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												(63)
Output from w/h												
226.5736	199.7341	209.8387	188.2090	184.5130	164.9759	158.5432	173.8311	173.4803	195.1569	206.2296	221.1569	(64)
Heat gains from water heating, kWh/month												
101.0046	89.5964	95.4403	87.4204	87.0195	79.6954	78.3846	83.4678	82.5231	90.5586	93.4122	99.2036	(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	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
32.4857	28.8535	23.4652	17.7647	13.2793	11.2110	12.1138	15.7460	21.1343	26.8348	31.3202	33.3885	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
362.9712	366.7377	357.2462	337.0400	311.5333	287.5605	271.5453	267.7788	277.2703	297.4765	322.9832	346.9559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	(71)
Water heating gains (Table 5)												
135.7589	133.3280	128.2800	121.4172	116.9617	110.6880	105.3556	112.1879	114.6154	121.7185	129.7392	133.3382	(72)
Total internal gains												
602.0801	599.7835	579.8557	547.0862	512.6386	480.3238	459.8790	466.5770	483.8842	516.8941	554.9069	584.5470	(73)

6. Solar gains

[Jan]												
	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m2	Table 6a	W/m2	or Table 6b	or Table 6c	factor	W					
						Table 6d						
Northeast	6.0100	11.2829	0.6300		0.7000	0.7700	20.7238	(75)				
Southeast	15.7300	36.7938	0.6300		0.7000	0.7700	176.8787	(77)				
Southwest	3.6700	36.7938	0.6300		0.7000	0.7700	41.2680	(79)				
Northwest	14.2100	11.2829	0.6300		0.7000	0.7700	48.9991	(81)				
Solar gains	287.8695	513.5074	764.1181	1049.8875	1270.0738	1302.2862	1238.3154	1067.7177	862.0837	584.1211	349.0189	243.6273 (83)
Total gains	889.9496	1113.2909	1343.9738	1596.9737	1782.7124	1782.6101	1698.1944	1534.2946	1345.9680	1101.0152	903.9258	828.1743 (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	59.8236	59.9755	60.1251	60.8380	60.9733	61.6109	61.6109	61.7305	61.3637	60.9733	60.7003	60.4174
alpha	4.9882	4.9984	5.0083	5.0559	5.0649	5.1074	5.1074	5.1154	5.0909	5.0649	5.0467	5.0278
util living area	0.9994	0.9980	0.9925	0.9676	0.8841	0.7151	0.5464	0.6198	0.8766	0.9866	0.9985	0.9996 (86)
MIT	19.6181	19.7956	20.0819	20.4595	20.7775	20.9472	20.9891	20.9801	20.8445	20.4189	19.9478	19.5921 (87)
Th 2	19.9515	19.9538	19.9562	19.9671	19.9692	19.9787	19.9787	19.9805	19.9750	19.9692	19.9650	19.9607 (88)
util rest of house	0.9992	0.9972	0.9897	0.9548	0.8401	0.6241	0.4263	0.4954	0.8119	0.9794	0.9978	0.9994 (89)
MIT 2	18.0944	18.3556	18.7744	19.3232	19.7486	19.9434	19.9747	19.9722	19.8447	19.2742	18.5866	18.0629 (90)
Living area fraction									fLA = Living area / (4) =			0.1149 (91)
MIT	18.2695	18.5211	18.9246	19.4538	19.8668	20.0587	20.0912	20.0880	19.9596	19.4057	18.7430	18.2386 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2695	18.5211	18.9246	19.4538	19.8668	20.0587	20.0912	20.0880	19.9596	19.4057	18.7430	18.2386 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9986	0.9957	0.9856	0.9464	0.8349	0.6318	0.4400	0.5092	0.8108	0.9737	0.9966	0.9990 (94)
Useful gains	888.7058	1108.4966	1324.6472	1511.3144	1488.4580	1126.2669	747.2194	781.3385	1091.2583	1072.0093	900.8187	827.3674 (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												
	3106.6721	3021.5177	2749.2597	2307.9140	1781.9598	1178.7519	753.8909	794.8283	1270.4054	1921.3805	2551.8811	3091.3580 (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												
	1650.1669	1285.5502	1059.9117	573.5517	218.3654	0.0000	0.0000	0.0000	0.0000	631.9322	1188.7650	1684.4090 (98)
Space heating												8292.6521 (98)
Space heating per m2											(98) / (4) =	43.2856 (99)

8c. Space cooling requirement

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													8869.1466 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1650.1669	1285.5502	1059.9117	573.5517	218.3654	0.0000	0.0000	0.0000	0.0000	631.9322	1188.7650	1684.4090	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	1764.8844	1374.9200	1133.5954	613.4243	233.5459	0.0000	0.0000	0.0000	0.0000	675.8633	1271.4064	1801.5070	(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	226.5736	199.7341	209.8387	188.2090	184.5130	164.9759	158.5432	173.8311	173.4803	195.1569	206.2296	221.1569	(64)
Efficiency of water heater (217)m	89.0583	88.8971	88.5381	87.5980	85.2640	79.8000	79.8000	79.8000	79.8000	87.7245	88.7409	79.8000	(216)
Fuel for water heating, kWh/month	254.4103	224.6802	237.0039	214.8554	216.4019	206.7367	198.6757	217.8335	217.3938	222.4656	232.3951	248.1752	(219)
Water heating fuel used												2691.0273	(219)
Annual totals kWh/year													
Space heating fuel - main system												8869.1466	(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)												573.7068	(232)
Total delivered energy for all uses												12208.8807	(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	8869.1466	0.2160	1915.7357 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2691.0273	0.2160	581.2619 (264)
Space and water heating			2496.9976 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	573.7068	0.5190	297.7538 (268)
Total CO2, kg/m2/year			2833.6764 (272)
Emissions per m2 for space and water heating			13.0337 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.5542 (272b)
Emissions per m2 for pumps and fans			0.2032 (272c)
Target Carbon Dioxide Emission Rate (TER) = (13.0337 * 1.00) + 1.5542 + 0.2032, rounded to 2 d.p.			14.7900 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (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					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.0811 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.2816 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2816 (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	0.3590	0.3520	0.3450	0.3098	0.3027	0.2675	0.2675	0.2605	0.2816	0.3027	0.3168	0.3309 (22b)
Effective ac	0.5645	0.5620	0.5595	0.5480	0.5458	0.5358	0.5358	0.5339	0.5396	0.5458	0.5502	0.5547 (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
Window (Uw = 1.20)			32.2700	1.1450	36.9504		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			96.9700	0.1100	10.6667	75.0000	7272.7500 (28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.2500	41.4075	52.8000	8745.2640 (29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.0900	8.5149	9.0000	851.4900 (30)
Bay Plane	2.3600		2.3600	0.1400	0.3304	9.0000	21.2400 (30)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7642		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			94.6100			13.8000	1305.6180 (32d)
Internal Ceiling			94.6100			9.0000	851.4900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25453.4520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							132.8607 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6372 (36)
Total fabric heat loss						(33) + (36) =	118.4014 (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	91.8749	91.4675	91.0682	89.1927	88.8417	87.2082	87.2082	86.9057	87.8374	88.8417	89.5516	90.2938 (38)
Heat transfer coeff	210.2763	209.8689	209.4696	207.5941	207.2432	205.6096	205.6096	205.3071	206.2388	207.2432	207.9530	208.6952 (39)
Average = Sum(39)m / 12 =												207.5924 (39)
HLP	1.0976	1.0955	1.0934	1.0836	1.0818	1.0732	1.0732	1.0717	1.0765	1.0818	1.0855	1.0893 (40)
HLP (average)												1.0836 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9910 (42)
Average daily hot water use (litres/day)												105.2352 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	120.3447	140.2501	153.0940	166.2501 (45)
Energy content (annual)										Total =	Sum (45)m =	1655.7592 (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	36.4792	31.9049	32.9230	28.7031	27.5413	23.7661	22.0227	25.2714	25.5732	29.8032	32.5325	35.3282 (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	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4857	28.8535	23.4652	17.7647	13.2793	11.2110	12.1138	15.7460	21.1343	26.8348	31.3202	33.3885 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.9712	366.7377	357.2462	337.0400	311.5333	287.5605	271.5453	267.7788	277.2703	297.4765	322.9832	346.9559 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548 (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)	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382 (71)
Water heating gains (Table 5)	49.0312	47.4776	44.2514	39.8654	37.0179	33.0084	29.6005	33.9670	35.5184	40.0580	45.1840	47.4841 (72)
Total internal gains	512.3523	510.9331	492.8271	462.5344	429.6948	399.6442	381.1239	385.3561	401.7872	432.2336	467.3517	495.6929 (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
Northeast	6.0100	11.2829	0.4600	0.0000	0.7700	24.0185 (75)
Southeast	8.3800	36.7938	0.4600	0.0000	0.7700	109.2113 (77)
Southwest	3.6700	36.7938	0.4600	0.0000	0.7700	47.8288 (79)
Northwest	14.2100	11.2829	0.4600	0.0000	0.7700	56.7891 (81)
Southeast	7.3500	36.7938	0.4300	0.0000	0.7700	89.5409 (77)

Solar gains	327.3886	584.5049	871.0397	1198.7609	1451.7866	1489.2663	1415.8453	1219.7417	983.3747	665.2253	397.0241	277.0135 (83)
Total gains	839.7409	1095.4379	1363.8668	1661.2953	1881.4814	1888.9105	1796.9692	1605.0978	1385.1620	1097.4589	864.3758	772.7064 (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	33.6243	33.6896	33.7538	34.0588	34.1165	34.3875	34.3875	34.4382	34.2826	34.1165	34.0000	33.8791
alpha	3.2416	3.2460	3.2503	3.2706	3.2744	3.2925	3.2925	3.2959	3.2855	3.2744	3.2667	3.2586
util living area	0.9926	0.9824	0.9578	0.8943	0.7752	0.6151	0.4759	0.5414	0.7769	0.9430	0.9863	0.9943 (86)
MIT	18.8827	19.1783	19.6297	20.1854	20.6276	20.8773	20.9606	20.9399	20.7240	20.1100	19.3830	18.8302 (87)
Th 2	20.0028	20.0045	20.0062	20.0143	20.0158	20.0228	20.0228	20.0241	20.0201	20.0158	20.0127	20.0096 (88)
util rest of house	0.9912	0.9790	0.9494	0.8732	0.7314	0.5427	0.3806	0.4431	0.7162	0.9273	0.9831	0.9932 (89)
MIT 2	18.0503	18.3451	18.7917	19.3342	19.7399	19.9512	20.0069	19.9979	19.8379	19.2741	18.5564	18.0029 (90)
Living area fraction									fLA = Living area / (4) =			0.1149 (91)
MIT	18.1459	18.4408	18.8880	19.4320	19.8419	20.0576	20.1165	20.1061	19.9397	19.3702	18.6514	18.0980 (92)
Temperature adjustment												0.0000
adjusted MIT	18.1459	18.4408	18.8880	19.4320	19.8419	20.0576	20.1165	20.1061	19.9397	19.3702	18.6514	18.0980 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	829.0693	1064.3975	1278.3326	1425.9781	1359.8615	1030.3046	701.0117	725.2612	984.1598	1003.2085	844.4913	765.0659 (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	2911.4659	2841.8011	2594.9001	2186.3766	1687.3497	1122.1312	723.0197	760.8863	1204.3816	1817.5578	2402.1414	2900.4364 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	1549.3030	1194.4152	979.5262	547.4869	243.6512	0.0000	0.0000	0.0000	0.0000	605.8759	1121.5080	1588.7156 (98)
Space heating												7830.4822 (98)
Space heating per m2										(98) / (4) =		40.8732 (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
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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	1932.7304	1521.5111	1560.3340	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8353	0.8887	0.8542	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1614.3812	1352.1810	1332.8465	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2346.6873	2235.8164	2014.4298	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	527.2604	657.4248	507.0979	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1691.7831	(104)
Intermittency factor (Table 10b)												1.0000	(105)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh													
	0.0000	0.0000	0.0000	0.0000	0.0000	131.8151	164.3562	126.7745	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												422.9458	(107)
Energy for space heating												2.2077	(108)
Energy for space cooling												40.8732	(99)
Total												2.2077	(108)
Dwelling Fabric Energy Efficiency (DFEE)												43.0808	(109)
												43.1	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (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					4 * 10 = 40.0000 (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) =					40.0000 / (5) = 0.0811 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3311 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3311 (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	0.4221	0.4139	0.4056	0.3642	0.3559	0.3145	0.3145	0.3063	0.3311	0.3559	0.3725	0.3890 (22b)
Effective ac	0.5891	0.5856	0.5823	0.5663	0.5633	0.5495	0.5495	0.5469	0.5548	0.5633	0.5694	0.5757 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			39.6200	1.3258	52.5265		(27)
FP McCann System			96.9700	0.1300	12.6061		(28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.1800	29.8134		(29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.1300	12.2993		(30)
Bay Plane	2.3600		2.3600	0.1300	0.3068		(30)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	109.7021	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.8005 (36)
Total fabric heat loss						(33) + (36) =	126.5026 (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	95.8873	95.3241	94.7721	92.1792	91.6941	89.4358	89.4358	89.0176	90.3057	91.6941	92.6755	93.7015 (38)
Heat transfer coeff	222.3899	221.8268	221.2747	218.6818	218.1967	215.9384	215.9384	215.5202	216.8083	218.1967	219.1781	220.2041 (39)
Average = Sum(39)m / 12 =												218.6795 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1608	1.1579	1.1550	1.1415	1.1389	1.1271	1.1271	1.1250	1.1317	1.1389	1.1441	1.1494 (40)
HLP (average)												1.1415 (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												2.9910 (42)
Average daily hot water use (litres/day)												105.2352 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587 (44)
Energy conte	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	140.2501	153.0940	166.2501	166.2501 (45)
Energy content (annual)												Total = Sum(45)m = 1655.7592 (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)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	36.4792	31.9049	32.9230	28.7031	27.5413	23.7661	22.0227	25.2714	25.5732	29.8032	32.5325	35.3282 (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	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	149.5478	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	32.4857	28.8535	23.4652	17.7647	13.2793	11.2110	12.1138	15.7460	21.1343	26.8348	31.3202	33.3885	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	362.9712	366.7377	357.2462	337.0400	311.5333	287.5605	271.5453	267.7788	277.2703	297.4765	322.9832	346.9559	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	37.9548	(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)	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	(71)
Water heating gains (Table 5)	49.0312	47.4776	44.2514	39.8654	37.0179	33.0084	29.6005	33.9670	35.5184	40.0580	45.1840	47.4841	(72)
Total internal gains	512.3523	510.9331	492.8271	462.5344	429.6948	399.6442	381.1239	385.3561	401.7872	432.2336	467.3517	495.6929	(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	
Northeast	6.0100	11.2829	0.6300	0.7000	0.7700	20.7238	(75)
Southeast	15.7300	36.7938	0.6300	0.7000	0.7700	176.8787	(77)
Southwest	3.6700	36.7938	0.6300	0.7000	0.7700	41.2680	(79)
Northwest	14.2100	11.2829	0.6300	0.7000	0.7700	48.9991	(81)

Solar gains	287.8695	513.5074	764.1181	1049.8875	1270.0738	1302.2862	1238.3154	1067.7177	862.0837	584.1211	349.0189	243.6273	(83)
Total gains	800.2219	1024.4405	1256.9452	1512.4219	1699.7686	1701.9304	1619.4393	1453.0737	1263.8709	1016.3547	816.3705	739.3202	(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	59.8236	59.9755	60.1251	60.8380	60.9733	61.6109	61.6109	61.7305	61.3637	60.9733	60.7003	60.4174	
alpha	4.9882	4.9984	5.0083	5.0559	5.0649	5.1074	5.1074	5.1154	5.0909	5.0649	5.0467	5.0278	
util living area	0.9996	0.9986	0.9944	0.9738	0.8995	0.7388	0.5701	0.6483	0.8975	0.9905	0.9990	0.9998	(86)
MIT	19.5743	19.7525	20.0408	20.4239	20.7542	20.9386	20.9868	20.9757	20.8221	20.3798	19.9051	19.5487	(87)
Th 2	19.9515	19.9538	19.9562	19.9671	19.9692	19.9787	19.9787	19.9805	19.9750	19.9692	19.9650	19.9607	(88)
util rest of house	0.9995	0.9981	0.9923	0.9630	0.8590	0.6483	0.4463	0.5211	0.8391	0.9852	0.9986	0.9997	(89)
MIT 2	18.6398	18.8197	19.1087	19.4940	19.8001	19.9502	19.9753	19.9734	19.8701	19.4568	18.9813	18.6215	(90)
Living area fraction									fLA = Living area / (4) =			0.1149	(91)
MIT	18.7472	18.9269	19.2158	19.6008	19.9097	20.0637	20.0915	20.0885	19.9795	19.5629	19.0875	18.7280	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7472	18.9269	19.2158	19.6008	19.9097	20.0637	20.0915	20.0885	19.9795	19.5629	19.0875	18.7280	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9993	0.9974	0.9901	0.9581	0.8562	0.6566	0.4605	0.5355	0.8394	0.9822	0.9981	0.9995	(94)
Ext temp.	799.6363	1021.7739	1244.5577	1449.0401	1455.3794	1117.4644	745.7622	778.0677	1060.8602	998.2768	814.8261	738.9604	(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	3212.9089	3111.5375	2813.6851	2340.0737	1791.3309	1179.8281	753.9580	794.9486	1274.7252	1955.6678	2627.3882	3199.1320	(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	1795.4748	1404.3212	1167.4308	641.5442	249.9480	0.0000	0.0000	0.0000	0.0000	712.2989	1305.0447	1830.3677	(98)
Space heating												9106.4301	(98)
Space heating per m2										(98) / (4) =		47.5333	(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	2029.8210	1597.9442	1637.9535	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8554	0.9182	0.8804	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1736.2762	1467.1749	1442.0514	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2128.1391	2028.3139	1836.7393	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	282.1413	417.4874	293.6478	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												993.2765 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	70.5353	104.3719	73.4120	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												248.3191 (107)
Energy for space heating												1.2962 (108)
Energy for space cooling												47.5333 (99)
Total												1.2962 (108)
Target Fabric Energy Efficiency (TFEE)												48.8295 (109)
												56.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (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												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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 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
Window (Uw = 1.20)			32.2700	1.1450	36.9504		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			96.9700	0.1100	10.6667	75.0000	7272.7500 (28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.2500	41.4075	52.8000	8745.2640 (29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.0900	8.5149	9.0000	851.4900 (30)
Bay Plane	2.3600		2.3600	0.1400	0.3304	9.0000	21.2400 (31)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.7642		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			94.6100			13.8000	1305.6180 (32d)
Internal Ceiling			94.6100			9.0000	851.4900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25453.4520 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							132.8607 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6372 (36)
Total fabric heat loss						(33) + (36) =	118.4014 (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	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839 (38)
Heat transfer coeff	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853 (39)
Average = Sum(39)m / 12 =												199.7853 (39)
HLP	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428 (40)
HLP (average)												1.0428 (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	2.9910 (42)
Average daily hot water use (litres/day)	105.2352 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587	(44)
Energy conte	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	120.3447	140.2501	153.0940	166.2501	(45)
Energy content (annual)	Total = Sum(45)m =											1655.7592	(45)
Distribution loss (46)m = 0.15 x (45)m	25.7500	22.5211	23.2398	20.2610	19.4409	16.7760	15.5455	17.8387	18.0517	21.0375	22.9641	24.9375	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9504	(55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	224.3916	197.7633	207.6567	186.0974	182.3310	162.8643	156.3613	171.6491	171.3687	192.9749	204.1180	218.9749	(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	224.3916	197.7633	207.6567	186.0974	182.3310	162.8643	156.3613	171.6491	171.3687	192.9749	204.1180	218.9749	(64)
RHI water heating demand												2277	(64)
Heat gains from water heating, kWh/month	99.2591	88.0198	93.6947	85.7311	85.2739	78.0061	76.6390	81.7222	80.8338	88.8130	91.7229	97.4580	(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	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.2141	72.1337	58.6630	44.4117	33.1983	28.0274	30.2846	39.3650	52.8357	67.0870	78.3004	83.4713	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	541.7480	547.3697	533.2033	503.0448	464.9750	429.1948	405.2915	399.6698	413.8362	443.9947	482.0645	517.8447	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	(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)	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	(71)
Water heating gains (Table 5)	133.4127	130.9818	125.9338	119.0710	114.6154	108.3418	103.0094	109.8416	112.2692	119.3723	127.3930	130.9920	(72)
Total internal gains	875.1306	869.2409	836.5559	785.2832	731.5445	684.3198	657.3412	667.6323	697.6968	749.2098	806.5137	851.0637	(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
Northeast				6.0100	12.9236		0.4600		0.0000		0.7700		27.5109 (75)
Southeast				8.3800	40.4699		0.4600		0.0000		0.7700		120.1226 (77)
Southwest				3.6700	40.4699		0.4600		0.0000		0.7700		52.6074 (79)
Northwest				14.2100	12.9236		0.4600		0.0000		0.7700		65.0466 (81)
Southeast				7.3500	40.4699		0.4300		0.0000		0.7700		98.4870 (77)
Solar gains	363.7746	586.0232	867.0311	1236.4775	1463.3908	1607.9103	1511.6053	1328.9026	1063.4862	713.3613	452.2649	304.6398	(83)
Total gains	1238.9052	1455.2642	1703.5870	2021.7607	2194.9353	2292.2301	2168.9465	1996.5349	1761.1830	1462.5711	1258.7785	1155.7035	(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	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900
alpha	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593
util living area	0.9738	0.9557	0.9106	0.8049	0.6371	0.4203	0.2825	0.3154	0.5922	0.8561	0.9528	0.9784 (86)
MIT	19.4169	19.6453	20.0632	20.5256	20.8395	20.9714	20.9947	20.9923	20.9070	20.4971	19.8767	19.3561 (87)
Th 2	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478 (88)
util rest of house	0.9689	0.9477	0.8944	0.7717	0.5810	0.3458	0.1971	0.2238	0.5141	0.8224	0.9425	0.9743 (89)
MIT 2	17.9458	18.2738	18.8672	19.4979	19.8915	20.0290	20.0460	20.0451	19.9735	19.4771	18.6113	17.8584 (90)
Living area fraction	fLA = Living area / (4) = 0.1149 (91)											
MIT	18.1148	18.4314	19.0046	19.6160	20.0004	20.1373	20.1550	20.1539	20.0807	19.5942	18.7567	18.0304 (92)
Temperature adjustment	-0.1500											
adjusted MIT	17.9648	18.2814	18.8546	19.4660	19.8504	19.9873	20.0050	20.0039	19.9307	19.4442	18.6067	17.8804 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9534	0.9274	0.8690	0.7485	0.5685	0.3409	0.1933	0.2195	0.5037	0.7965	0.9213	0.9606	(94)
Useful gains	1181.2156	1349.6714	1480.4002	1513.2206	1247.7953	781.5256	419.1822	438.1640	887.1702	1164.8860	1159.7143	1110.1450	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	2570.2027	2533.5487	2288.4601	1911.1397	1368.6154	796.5972	420.5540	440.3053	945.1312	1567.1660	2119.0677	2553.3439 (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	1033.4064	795.5656	601.1965	286.5018	89.8902	0.0000	0.0000	0.0000	0.0000	299.2963	690.7345	1073.7400 (98)
Space heating												4870.3312 (98)
RHI space heating demand												4870 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (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	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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 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
Window (Uw = 1.20)			32.2700	1.1450	36.9504		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			96.9700	0.1100	10.6667	75.0000	7272.7500 (28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.2500	41.4075	52.8000	8745.2640 (29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.0900	8.5149	9.0000	851.4900 (30)
Bay Plane	2.3600		2.3600	0.1400	0.3304	9.0000	21.2400 (31)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.7642		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			94.6100			13.8000	1305.6180 (32d)
Internal Ceiling			94.6100			9.0000	851.4900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25453.4520 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							132.8607 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6372 (36)
Total fabric heat loss						(33) + (36) =	118.4014 (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	82.3015	81.4857	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839 (38)
Heat transfer coeff	200.7029	199.8871	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853 (39)
Average = Sum(39)m / 12 =												199.8703 (39)
HLP	1.0476	1.0434	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428 (40)
HLP (average)												1.0433 (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	2.9910 (42)
Average daily hot water use (litres/day)	105.2352 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587	(44)
Energy content (annual)	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	120.3447	140.2501	153.0940	166.2501	(45)
Distribution loss	Total = Sum (45)m = 1655.7592 (45)												
	(46)m = 0.15 x (45)m												
	25.7500	22.5211	23.2398	20.2610	19.4409	16.7760	15.5455	17.8387	18.0517	21.0375	22.9641	24.9375	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9504 (55)
Total storage loss													
	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(56)
If cylinder contains dedicated solar storage													
	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	224.3916	197.7633	207.6567	186.0974	182.3310	162.8643	156.3613	171.6491	171.3687	192.9749	204.1180	218.9749	(62)
WWHRS	-43.5233	-38.2968	-39.0858	-32.1458	-29.8414	-24.6130	-20.8223	-25.2138	-25.9532	-32.0925	-37.1874	-42.0701	eq. (G10)
Total of WWHRS savings													-390.8453
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input	(sum of months) =	Sum (63)m =		0.0000	(63)
Output from w/h	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049	(64)
								Total per year (kWh/year) =	Sum (64)m =			1885.7059	(64)
Heat gains from water heating, kWh/month													
	99.2591	88.0198	93.6947	85.7311	85.2739	78.0061	76.6390	81.7222	80.8338	88.8130	91.7229	97.4580	(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	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.2141	72.1337	58.6630	44.4117	33.1983	28.0274	30.2846	39.3650	52.8357	67.0870	78.3004	83.4713	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	541.7480	547.3697	533.2033	503.0448	464.9750	429.1948	405.2915	399.6698	413.8362	443.9947	482.0645	517.8447	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	(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)													
	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	(71)
Water heating gains (Table 5)													
	133.4127	130.9818	125.9338	119.0710	114.6154	108.3418	103.0094	109.8416	112.2692	119.3723	127.3930	130.9920	(72)
Total internal gains													
	875.1306	869.2409	836.5559	785.2832	731.5445	684.3198	657.3412	667.6323	697.6968	749.2098	806.5137	851.0637	(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	
Northeast	6.0100	11.2829	0.4600	0.0000	0.7700	24.0185	(75)
Southeast	8.3800	36.7938	0.4600	0.0000	0.7700	109.2113	(77)
Southwest	3.6700	36.7938	0.4600	0.0000	0.7700	47.8288	(79)
Northwest	14.2100	11.2829	0.4600	0.0000	0.7700	56.7891	(81)
Southeast	7.3500	36.7938	0.4300	0.0000	0.7700	89.5409	(77)

Solar gains	327.3886	584.5049	871.0397	1198.7609	1451.7866	1489.2663	1415.8453	1219.7417	983.3747	665.2253	397.0241	277.0135	(83)
Total gains	1202.5193	1453.7458	1707.5955	1984.0441	2183.3312	2173.5861	2073.1865	1887.3740	1681.0715	1414.4351	1203.5378	1128.0772	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)

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	35.2282	35.3720	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	
alpha	3.3485	3.3581	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	
util living area	0.9790	0.9607	0.9227	0.8401	0.7050	0.5430	0.4100	0.4636	0.6891	0.8921	0.9649	0.9828	(86)
MIT	19.2552	19.5366	19.9383	20.3969	20.7439	20.9210	20.9767	20.9647	20.8232	20.3443	19.7017	19.1939	(87)
Th 2	20.0438	20.0474	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	(88)
util rest of house	0.9752	0.9539	0.9093	0.8130	0.6582	0.4750	0.3267	0.3763	0.6240	0.8672	0.9576	0.9797	(89)
MIT 2	17.7086	18.1163	18.6897	19.3249	19.7764	19.9819	20.0343	20.0259	19.8838	19.2699	18.3598	17.6222	(90)
Living area fraction													
MIT	17.8863	18.2794	18.8331	19.4481	19.8875	20.0898	20.1426	20.1338	19.9918	19.3933	18.5139	17.8027	(91)
Temperature adjustment													
adjusted MIT	17.7363	18.1294	18.6831	19.2981	19.7375	19.9398	19.9926	19.9838	19.8418	19.2433	18.3639	17.6527	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9618	0.9348	0.8847	0.7880	0.6416	0.4669	0.3217	0.3701	0.6084	0.8407	0.9392	0.9679	(94)
Useful gains	1156.5625	1358.9835	1510.6723	1563.4072	1400.7326	1014.7462	667.0390	698.6057	1022.6888	1189.1589	1130.3596	1091.8225	(95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	2696.6953	2644.3921	2434.0078	2077.3846	1605.7835	1066.8195	677.7884	715.9843	1147.1192	1726.8056	2250.3673	2687.6603 (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	1145.8588	863.7946	686.9616	370.0637	152.5579	0.0000	0.0000	0.0000	0.0000	400.0091	806.4056	1187.3033 (98)
Space heating												5612.9546 (98)
Space heating per m2											(98) / (4) =	29.2982 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6195.3141 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1145.8588	863.7946	686.9616	370.0637	152.5579	0.0000	0.0000	0.0000	0.0000	400.0091	806.4056	1187.3033 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1264.7448	953.4156	758.2358	408.4589	168.3862	0.0000	0.0000	0.0000	0.0000	441.5111	890.0724	1310.4893 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049 (64)
Efficiency of water heater	88.9756	88.7478	88.2708	87.1704	84.9154	79.9000	79.9000	79.9000	79.9000	87.2486	88.5659	79.9000 (216)
Fuel for water heating, kWh/month	203.2785	179.6849	190.9701	176.6100	179.5781	173.0304	169.6358	183.2732	181.9968	184.3954	188.4818	198.6501 (219)
Water heating fuel used												2209.5853 (219)
Annual totals kWh/year												
Space heating fuel - main system												6195.3141 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 14.1050, total flow = 61.0000, SFP = 0.2312)												
mechanical ventilation fans (SFP = 0.2312)												139.1418 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												214.1418 (231)
Electricity for lighting (calculated in Appendix L)												573.7068 (232)
Total delivered energy for all uses												9192.7481 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	6195.3141	3.4800	215.5969 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2209.5853	3.4800	76.8936 (247)
Mechanical ventilation fans	139.1418	13.1900	18.3528 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	573.7068	13.1900	75.6719 (250)
Additional standing charges			120.0000 (251)
Total energy cost			516.4077 (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] =	0.9168 (257)
SAP value		87.2110
SAP rating (Section 12)		87 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	6195.3141	0.2160	1338.1878 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2209.5853	0.2160	477.2704 (264)
Space and water heating			1815.4583 (265)
Pumps and fans	214.1418	0.5190	111.1396 (267)
Energy for lighting	573.7068	0.5190	297.7538 (268)
Total kg/year			2224.3517 (272)
CO2 emissions per m2			11.6100 (273)
EI value			87.4012
EI rating			87 (274)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

EI band

B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9060 = 3.841$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9060 = 0.2384$, stars = 4
Water heating energy efficiency	$3.48 / 0.8521 = 4.084$, stars = 5
Water heating environmental impact	$0.216 / 0.8521 = 0.2535$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (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												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												0 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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 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
Window (Uw = 1.20)			32.2700	1.1450	36.9504		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			96.9700	0.1100	10.6667	75.0000	7272.7500 (28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.2500	41.4075	52.8000	8745.2640 (29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.0900	8.5149	9.0000	851.4900 (30)
Bay Plane	2.3600		2.3600	0.1400	0.3304	9.0000	21.2400 (31)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.7642		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			94.6100			13.8000	1305.6180 (32d)
Internal Ceiling			94.6100			9.0000	851.4900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25453.4520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							132.8607 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6372 (36)
Total fabric heat loss						(33) + (36) =	118.4014 (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	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839 (38)
Heat transfer coeff	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853 (39)
Average = Sum(39)m / 12 =												199.7853 (39)
HLP	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428 (40)
HLP (average)												1.0428 (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	2.9910 (42)
Average daily hot water use (litres/day)	105.2352 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587	(44)
Energy conte	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	120.3447	140.2501	153.0940	166.2501	(45)
Energy content (annual)	Total = Sum (45)m =											1655.7592	(45)
Distribution loss (46)m = 0.15 x (45)m	25.7500	22.5211	23.2398	20.2610	19.4409	16.7760	15.5455	17.8387	18.0517	21.0375	22.9641	24.9375	(46)
Water storage loss:													
Store volume												250.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.7600	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.9504	(55)
Total storage loss	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(56)
If cylinder contains dedicated solar storage	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month	224.3916	197.7633	207.6567	186.0974	182.3310	162.8643	156.3613	171.6491	171.3687	192.9749	204.1180	218.9749	(62)
WWHRS	-43.5233	-38.2968	-39.0858	-32.1458	-29.8414	-24.6130	-20.8223	-25.2138	-25.9532	-32.0925	-37.1874	-42.0701	eq. (G10)
Total of WWHRS savings	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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049	(64)
Heat gains from water heating, kWh/month	99.2591	88.0198	93.6947	85.7311	85.2739	78.0061	76.6390	81.7222	80.8338	88.8130	91.7229	97.4580	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	(66)
(66)m	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.2141	72.1337	58.6630	44.4117	33.1983	28.0274	30.2846	39.3650	52.8357	67.0870	78.3004	83.4713	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	541.7480	547.3697	533.2033	503.0448	464.9750	429.1948	405.2915	399.6698	413.8362	443.9947	482.0645	517.8447	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	(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)	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	(71)
Water heating gains (Table 5)	133.4127	130.9818	125.9338	119.0710	114.6154	108.3418	103.0094	109.8416	112.2692	119.3723	127.3930	130.9920	(72)
Total internal gains	875.1306	869.2409	836.5559	785.2832	731.5445	684.3198	657.3412	667.6323	697.6968	749.2098	806.5137	851.0637	(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
Northeast				6.0100	12.9236		0.4600		0.0000		0.7700		27.5109 (75)
Southeast				8.3800	40.4699		0.4600		0.0000		0.7700		120.1226 (77)
Southwest				3.6700	40.4699		0.4600		0.0000		0.7700		52.6074 (79)
Northwest				14.2100	12.9236		0.4600		0.0000		0.7700		65.0466 (81)
Southeast				7.3500	40.4699		0.4300		0.0000		0.7700		98.4870 (77)
Solar gains	363.7746	586.0232	867.0311	1236.4775	1463.3908	1607.9103	1511.6053	1328.9026	1063.4862	713.3613	452.2649	304.6398	(83)
Total gains	1238.9052	1455.2642	1703.5870	2021.7607	2194.9353	2292.2301	2168.9465	1996.5349	1761.1830	1462.5711	1258.7785	1155.7035	(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	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	
alpha	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	
util living area	0.9738	0.9557	0.9106	0.8049	0.6371	0.4203	0.2825	0.3154	0.5922	0.8561	0.9528	0.9784	(86)
MIT	19.4169	19.6453	20.0632	20.5256	20.8395	20.9714	20.9947	20.9923	20.9070	20.4971	19.8767	19.3561	(87)
Th 2	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	(88)
util rest of house	0.9689	0.9477	0.8944	0.7717	0.5810	0.3458	0.1971	0.2238	0.5141	0.8224	0.9425	0.9743	(89)
MIT 2	17.9458	18.2738	18.8672	19.4979	19.8915	20.0290	20.0460	20.0451	19.9735	19.4771	18.6113	17.8584	(90)
Living area fraction	18.1148	18.4314	19.0046	19.6160	20.0004	20.1373	20.1550	20.1539	20.0807	19.5942	18.7567	18.0304	(91)
MIT	17.9648	18.2814	18.8546	19.4660	19.8504	19.9873	20.0050	20.0039	19.9307	19.4442	18.6067	17.8804	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9534	0.9274	0.8690	0.7485	0.5685	0.3409	0.1933	0.2195	0.5037	0.7965	0.9213	0.9606	(94)
Useful gains	1181.2156	1349.6714	1480.4002	1513.2206	1247.7953	781.5256	419.1822	438.1640	887.1702	1164.8860	1159.7143	1110.1450	(95)

FULL SAP CALCULATION PRINTOUT

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

Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2570.2027	2533.5487	2288.4601	1911.1397	1368.6154	796.5972	420.5540	440.3053	945.1312	1567.1660	2119.0677	2553.3439 (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	1033.4064	795.5656	601.1965	286.5018	89.8902	0.0000	0.0000	0.0000	0.0000	299.2963	690.7345	1073.7400 (98)
Space heating												4870.3312 (98)
Space heating per m2											(98) / (4) =	25.4219 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5375.6415 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1033.4064	795.5656	601.1965	286.5018	89.8902	0.0000	0.0000	0.0000	0.0000	299.2963	690.7345	1073.7400 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1140.6252	878.1077	663.5723	316.2271	99.2165	0.0000	0.0000	0.0000	0.0000	330.3491	762.4001	1185.1434 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049 (64)
Efficiency of water heater	88.8281	88.6184	88.0187	86.5488	83.5599	79.9000	79.9000	79.9000	79.9000	86.5479	88.2985	79.9000 (216)
(217)m	88.8281	88.6184	88.0187	86.5488	83.5599	79.9000	79.9000	79.9000	79.9000	86.5479	88.2985	88.9157 (217)
Fuel for water heating, kWh/month	203.6161	179.9473	191.5171	177.8784	182.4913	173.0304	169.6358	183.2732	181.9968	185.8883	189.0526	198.9580 (219)
Water heating fuel used												2217.2853 (219)
Annual totals kWh/year												
Space heating fuel - main system												5375.6415 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 14.1050, total flow = 61.0000, SFP = 0.2312)												
mechanical ventilation fans (SFP = 0.2312)												139.1418 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												214.1418 (231)
Electricity for lighting (calculated in Appendix L)												573.7068 (232)
Total delivered energy for all uses												8380.7754 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	5375.6415	3.9200	210.7251 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2217.2853	3.9200	86.9176 (247)
Mechanical ventilation fans	139.1418	16.9600	23.5985 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	573.7068	16.9600	97.3007 (250)
Additional standing charges			88.0000 (251)
Total energy cost			519.2619 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	5375.6415	0.2160	1161.1386 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2217.2853	0.2160	478.9336 (264)
Space and water heating			1640.0722 (265)
Pumps and fans	214.1418	0.5190	111.1396 (267)
Energy for lighting	573.7068	0.5190	297.7538 (268)
Total kg/year			2048.9656 (272)

13a. Primary energy - Individual heating systems including micro-CHP

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	5375.6415	1.2200	6558.2826 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2217.2853	1.2200	2705.0880 (264)
Space and water heating			9263.3707 (265)
Pumps and fans	214.1418	3.0700	657.4155 (267)
Energy for lighting	573.7068	3.0700	1761.2798 (268)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Primary energy kWh/year
Primary energy kWh/m²/year

11682.0660 (272)
60.9775 (273)

SAP 2012 EPC IMPROVEMENTS

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

(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	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
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
U Solar photovoltaic panels	+ 5.6	-£ 309	-947 kg (46.2%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 37	-224 kg (10.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309	4.94 kg/m ²	A 93 A 92
Total Savings	£309	4.94 kg/m ²	
Potential energy efficiency rating:			A 93
Potential environmental impact rating:			A 92

Fuel prices for cost data on this page from database revision number 440 TEST (26 Feb 2019)
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	£134	£134	£0
Mains gas	£386	£386	£0
Space heating	£335	£335	£0
Water heating	£87	£87	£0
Lighting	£97	£97	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£520	£211	£309
Total cost of uses	£519	£210	£309
Delivered energy	44 kWh/m ²	34 kWh/m ²	10 kWh/m ²
Carbon dioxide emissions	2.0 tonnes	1.1 tonnes	0.9 tonnes
CO2 emissions per m ²	11 kg/m ²	6 kg/m ²	5 kg/m ²
Primary energy	61 kWh/m ²	32 kWh/m ²	29 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (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	(8)
Measured/design AP50											4.0100	
Infiltration rate											0.2005	(18)
Number of sides sheltered											0	(19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.2005 (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	0.2556	0.2506	0.2456	0.2206	0.2155	0.1905	0.1905	0.1855	0.2005	0.2155	0.2256	0.2356 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5056	0.5006	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 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
Window (Uw = 1.20)			32.2700	1.1450	36.9504		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			96.9700	0.1100	10.6667	75.0000	7272.7500 (28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.2500	41.4075	52.8000	8745.2640 (29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.0900	8.5149	9.0000	851.4900 (30)
Bay Plane	2.3600		2.3600	0.1400	0.3304	9.0000	21.2400 (31)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.7642		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			94.6100			13.8000	1305.6180 (32d)
Internal Ceiling			94.6100			9.0000	851.4900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25453.4520 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							132.8607 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6372 (36)
Total fabric heat loss						(33) + (36) =	118.4014 (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	82.3015	81.4857	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839	81.3839 (38)
Heat transfer coeff	200.7029	199.8871	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853 (39)
Average = Sum(39)m / 12 =												199.8703 (39)
HLP	1.0476	1.0434	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428	1.0428 (40)
HLP (average)												1.0433 (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	2.9910 (42)
Average daily hot water use (litres/day)	105.2352 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587	(44)
Energy content (annual)	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	120.3447	140.2501	153.0940	166.2501	(45)
Distribution loss	Total = Sum (45)m = 1655.7592 (45)												
	(46)m = 0.15 x (45)m												
	25.7500	22.5211	23.2398	20.2610	19.4409	16.7760	15.5455	17.8387	18.0517	21.0375	22.9641	24.9375	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9504 (55)
Total storage loss													
	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(56)
If cylinder contains dedicated solar storage													
	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	224.3916	197.7633	207.6567	186.0974	182.3310	162.8643	156.3613	171.6491	171.3687	192.9749	204.1180	218.9749	(62)
WWHRS	-43.5233	-38.2968	-39.0858	-32.1458	-29.8414	-24.6130	-20.8223	-25.2138	-25.9532	-32.0925	-37.1874	-42.0701	eq. (G10)
Total of WWHRS savings													-390.8453
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum (63)m =	0.0000 (63)				
Output from w/h													
	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049	(64)
	Total per year (kWh/year) = Sum (64)m = 1885.7059 (64)												
Heat gains from water heating, kWh/month													
	99.2591	88.0198	93.6947	85.7311	85.2739	78.0061	76.6390	81.7222	80.8338	88.8130	91.7229	97.4580	(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	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	81.2141	72.1337	58.6630	44.4117	33.1983	28.0274	30.2846	39.3650	52.8357	67.0870	78.3004	83.4713	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	541.7480	547.3697	533.2033	503.0448	464.9750	429.1948	405.2915	399.6698	413.8362	443.9947	482.0645	517.8447	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	(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)													
	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	(71)
Water heating gains (Table 5)													
	133.4127	130.9818	125.9338	119.0710	114.6154	108.3418	103.0094	109.8416	112.2692	119.3723	127.3930	130.9920	(72)
Total internal gains													
	875.1306	869.2409	836.5559	785.2832	731.5445	684.3198	657.3412	667.6323	697.6968	749.2098	806.5137	851.0637	(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	
Northeast	6.0100	11.2829	0.4600	0.0000	0.7700	24.0185	(75)
Southeast	8.3800	36.7938	0.4600	0.0000	0.7700	109.2113	(77)
Southwest	3.6700	36.7938	0.4600	0.0000	0.7700	47.8288	(79)
Northwest	14.2100	11.2829	0.4600	0.0000	0.7700	56.7891	(81)
Southeast	7.3500	36.7938	0.4300	0.0000	0.7700	89.5409	(77)

Solar gains	327.3886	584.5049	871.0397	1198.7609	1451.7866	1489.2663	1415.8453	1219.7417	983.3747	665.2253	397.0241	277.0135	(83)
Total gains	1202.5193	1453.7458	1707.5955	1984.0441	2183.3312	2173.5861	2073.1865	1887.3740	1681.0715	1414.4351	1203.5378	1128.0772	(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	35.2282	35.3720	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	
alpha	3.3485	3.3581	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	
util living area	0.9790	0.9607	0.9227	0.8401	0.7050	0.5430	0.4100	0.4636	0.6891	0.8921	0.9649	0.9828	(86)
MIT	19.2552	19.5366	19.9383	20.3969	20.7439	20.9210	20.9767	20.9647	20.8232	20.3443	19.7017	19.1939	(87)
Th 2	20.0438	20.0474	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	(88)
util rest of house	0.9752	0.9539	0.9093	0.8130	0.6582	0.4750	0.3267	0.3763	0.6240	0.8672	0.9576	0.9797	(89)
MIT 2	17.7086	18.1163	18.6897	19.3249	19.7764	19.9819	20.0343	20.0259	19.8838	19.2699	18.3598	17.6222	(90)
Living area fraction													
MIT	17.8863	18.2794	18.8331	19.4481	19.8875	20.0898	20.1426	20.1338	19.9918	19.3933	18.5139	17.8027	(91)
Temperature adjustment												-0.1500	
adjusted MIT	17.7363	18.1294	18.6831	19.2981	19.7375	19.9398	19.9926	19.9838	19.8418	19.2433	18.3639	17.6527	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9618	0.9348	0.8847	0.7880	0.6416	0.4669	0.3217	0.3701	0.6084	0.8407	0.9392	0.9679	(94)
Useful gains	1156.5625	1358.9835	1510.6723	1563.4072	1400.7326	1014.7462	667.0390	698.6057	1022.6888	1189.1589	1130.3596	1091.8225	(95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	2696.6953	2644.3921	2434.0078	2077.3846	1605.7835	1066.8195	677.7884	715.9843	1147.1192	1726.8056	2250.3673	2687.6603 (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	1145.8588	863.7946	686.9616	370.0637	152.5579	0.0000	0.0000	0.0000	0.0000	400.0091	806.4056	1187.3033 (98)
Space heating												5612.9546 (98)
Space heating per m2											(98) / (4) =	29.2982 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												6195.3141 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1145.8588	863.7946	686.9616	370.0637	152.5579	0.0000	0.0000	0.0000	0.0000	400.0091	806.4056	1187.3033 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1264.7448	953.4156	758.2358	408.4589	168.3862	0.0000	0.0000	0.0000	0.0000	441.5111	890.0724	1310.4893 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049 (64)
Efficiency of water heater	88.9756	88.7478	88.2708	87.1704	84.9154	79.9000	79.9000	79.9000	79.9000	87.2486	88.5659	79.9000 (216)
Fuel for water heating, kWh/month	203.2785	179.6849	190.9701	176.6100	179.5781	173.0304	169.6358	183.2732	181.9968	184.3954	188.4818	198.6501 (219)
Water heating fuel used												2209.5853 (219)
Annual totals kWh/year												
Space heating fuel - main system												6195.3141 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 14.1050, total flow = 61.0000, SFP = 0.2312)												
mechanical ventilation fans (SFP = 0.2312)												139.1418 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												214.1418 (231)
Electricity for lighting (calculated in Appendix L)												573.7068 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394 (233)
Total delivered energy for all uses												7465.5087 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	6195.3141	3.4800	215.5969 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2209.5853	3.4800	76.8936 (247)
Mechanical ventilation fans	139.1418	13.1900	18.3528 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	573.7068	13.1900	75.6719 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			288.5849 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		0.5123 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	92.8531
SAP rating (Section 12)		93 (258)
SAP band		A

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	6195.3141	0.2160	1338.1878 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2209.5853	0.2160	477.2704 (264)
Space and water heating			1815.4583 (265)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Pumps and fans	214.1418	0.5190	111.1396 (267)
Energy For lighting	573.7068	0.5190	297.7538 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			1327.9145 (272)
EI value			6.9300 (273)
EI rating			92.4786
EI band			92 (274)
			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 WORKSHEET FOR New Build (As Designed) (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	96.9700 (1b)	x 2.5400 (2b)	= 246.3038 (1b) - (3b)
First floor	94.6100 (1c)	x 2.6100 (2c)	= 246.9321 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	191.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 493.2359 (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															4.0100		
Infiltration rate															0.2005 (18)		
Number of sides sheltered															0 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					1.0000 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.2005 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate	0.2105	0.2005	0.2005	0.1855	0.1855	0.1654	0.1704	0.1604	0.1654	0.1754	0.1754	0.1905 (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 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
Window (Uw = 1.20)			32.2700	1.1450	36.9504		(27)
French Door (Uw = 1.40)			7.3500	1.3258	9.7443		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			96.9700	0.1100	10.6667	75.0000	7272.7500 (28a)
100mm Knauf Supafil 34	207.4000	41.7700	165.6300	0.2500	41.4075	52.8000	8745.2640 (29a)
Plane Ceiling-500mm Loft Roll	94.6100		94.6100	0.0900	8.5149	9.0000	851.4900 (30)
Bay Plane	2.3600		2.3600	0.1400	0.3304	9.0000	21.2400 (31)
Total net area of external elements Aum(A, m ²)			401.3400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.7642		(33)
1F Timber			224.2900			9.0000	2018.6100 (32c)
GF Masonry			93.7300			39.0000	3655.4700 (32c)
GF Timber			81.2800			9.0000	731.5200 (32c)
Internal Floor			94.6100			13.8000	1305.6180 (32d)
Internal Ceiling			94.6100			9.0000	851.4900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25453.4520 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							132.8607 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6372 (36)
Total fabric heat loss						(33) + (36) =	118.4014 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 81.3839	Feb 81.3839	Mar 81.3839	Apr 81.3839	May 81.3839	Jun 81.3839	Jul 81.3839	Aug 81.3839	Sep 81.3839	Oct 81.3839	Nov 81.3839	Dec 81.3839 (38)
Heat transfer coeff	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853	199.7853 (39)
Average = Sum(39)m / 12 =												199.7853 (39)
HLP	Jan 1.0428	Feb 1.0428	Mar 1.0428	Apr 1.0428	May 1.0428	Jun 1.0428	Jul 1.0428	Aug 1.0428	Sep 1.0428	Oct 1.0428	Nov 1.0428	Dec 1.0428 (40)
HLP (average)												1.0428 (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	2.9910 (42)
Average daily hot water use (litres/day)	105.2352 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	115.7587	111.5493	107.3399	103.1305	98.9211	94.7117	94.7117	98.9211	103.1305	107.3399	111.5493	115.7587	(44)
Energy content (annual)	171.6668	150.1409	154.9319	135.0734	129.6062	111.8403	103.6365	118.9243	120.3447	140.2501	153.0940	166.2501	(45)
Energy content (annual)	Total = Sum(45)m =												1655.7592 (45)
Distribution loss	(46)m = 0.15 x (45)m												
	25.7500	22.5211	23.2398	20.2610	19.4409	16.7760	15.5455	17.8387	18.0517	21.0375	22.9641	24.9375	(46)
Water storage loss:													
Store volume													250.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													1.7600 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													0.9504 (55)
Total storage loss													
	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(56)
If cylinder contains dedicated solar storage													
	29.4624	26.6112	29.4624	28.5120	29.4624	28.5120	29.4624	29.4624	28.5120	29.4624	28.5120	29.4624	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	224.3916	197.7633	207.6567	186.0974	182.3310	162.8643	156.3613	171.6491	171.3687	192.9749	204.1180	218.9749	(62)
WWHRS	-43.5233	-38.2968	-39.0858	-32.1458	-29.8414	-24.6130	-20.8223	-25.2138	-25.9532	-32.0925	-37.1874	-42.0701	eq. (G10)
Total of WWHRS savings													-390.8453
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h													
	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049	(64)
	Total per year (kWh/year) = Sum(64)m =												1885.7059 (64)
Heat gains from water heating, kWh/month													
	99.2591	88.0198	93.6947	85.7311	85.2739	78.0061	76.6390	81.7222	80.8338	88.8130	91.7229	97.4580	(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	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573	179.4573 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	81.2141	72.1337	58.6630	44.4117	33.1983	28.0274	30.2846	39.3650	52.8357	67.0870	78.3004	83.4713 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	541.7480	547.3697	533.2033	503.0448	464.9750	429.1948	405.2915	399.6698	413.8362	443.9947	482.0645	517.8447 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367	55.9367 (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)	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382	-119.6382 (71)
Water heating gains (Table 5)	133.4127	130.9818	125.9338	119.0710	114.6154	108.3418	103.0094	109.8416	112.2692	119.3723	127.3930	130.9920 (72)
Total internal gains	875.1306	869.2409	836.5559	785.2832	731.5445	684.3198	657.3412	667.6323	697.6968	749.2098	806.5137	851.0637 (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
Northeast				6.0100	12.9236		0.4600		0.0000		0.7700		27.5109 (75)
Southeast				8.3800	40.4699		0.4600		0.0000		0.7700		120.1226 (77)
Southwest				3.6700	40.4699		0.4600		0.0000		0.7700		52.6074 (79)
Northwest				14.2100	12.9236		0.4600		0.0000		0.7700		65.0466 (81)
Southeast				7.3500	40.4699		0.4300		0.0000		0.7700		98.4870 (77)
Solar gains	363.7746	586.0232	867.0311	1236.4775	1463.3908	1607.9103	1511.6053	1328.9026	1063.4862	713.3613	452.2649	304.6398	(83)
Total gains	1238.9052	1455.2642	1703.5870	2021.7607	2194.9353	2292.2301	2168.9465	1996.5349	1761.1830	1462.5711	1258.7785	1155.7035	(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	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	35.3900	
alpha	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	3.3593	
util living area	0.9738	0.9557	0.9106	0.8049	0.6371	0.4203	0.2825	0.3154	0.5922	0.8561	0.9528	0.9784	(86)
MIT	19.4169	19.6453	20.0632	20.5256	20.8395	20.9714	20.9947	20.9923	20.9070	20.4971	19.8767	19.3561	(87)
Th 2	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	20.0478	(88)
util rest of house	0.9689	0.9477	0.8944	0.7717	0.5810	0.3458	0.1971	0.2238	0.5141	0.8224	0.9425	0.9743	(89)
MIT 2	17.9458	18.2738	18.8672	19.4979	19.8915	20.0290	20.0460	20.0451	19.9735	19.4771	18.6113	17.8584	(90)
Living area fraction													0.1149 (91)
MIT	18.1148	18.4314	19.0046	19.6160	20.0004	20.1373	20.1550	20.1539	20.0807	19.5942	18.7567	18.0304	(92)
Temperature adjustment													-0.1500
adjusted MIT	17.9648	18.2814	18.8546	19.4660	19.8504	19.9873	20.0050	20.0039	19.9307	19.4442	18.6067	17.8804	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9534	0.9274	0.8690	0.7485	0.5685	0.3409	0.1933	0.2195	0.5037	0.7965	0.9213	0.9606	(94)
Useful gains	1181.2156	1349.6714	1480.4002	1513.2206	1247.7953	781.5256	419.1822	438.1640	887.1702	1164.8860	1159.7143	1110.1450	(95)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	2570.2027	2533.5487	2288.4601	1911.1397	1368.6154	796.5972	420.5540	440.3053	945.1312	1567.1660	2119.0677	2553.3439 (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	1033.4064	795.5656	601.1965	286.5018	89.8902	0.0000	0.0000	0.0000	0.0000	299.2963	690.7345	1073.7400 (98)
Space heating												4870.3312 (98)
Space heating per m2											(98) / (4) =	25.4219 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.6000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5375.6415 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1033.4064	795.5656	601.1965	286.5018	89.8902	0.0000	0.0000	0.0000	0.0000	299.2963	690.7345	1073.7400 (98)
Space heating efficiency (main heating system 1)	90.6000	90.6000	90.6000	90.6000	90.6000	0.0000	0.0000	0.0000	0.0000	90.6000	90.6000	90.6000 (210)
Space heating fuel (main heating system)	1140.6252	878.1077	663.5723	316.2271	99.2165	0.0000	0.0000	0.0000	0.0000	330.3491	762.4001	1185.1434 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	180.8683	159.4665	168.5709	153.9516	152.4896	138.2513	135.5390	146.4353	145.4155	160.8825	166.9306	176.9049 (64)
Efficiency of water heater	88.8281	88.6184	88.0187	86.5488	83.5599	79.9000	79.9000	79.9000	79.9000	86.5479	88.2985	79.9000 (216)
Fuel for water heating, kWh/month	203.6161	179.9473	191.5171	177.8784	182.4913	173.0304	169.6358	183.2732	181.9968	185.8883	189.0526	198.9580 (219)
Water heating fuel used												2217.2853 (219)
Annual totals kWh/year												
Space heating fuel - main system												5375.6415 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 14.1050, total flow = 61.0000, SFP = 0.2312)												
mechanical ventilation fans (SFP = 0.2312)												139.1418 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												214.1418 (231)
Electricity for lighting (calculated in Appendix L)												573.7068 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596 (233)
Total delivered energy for all uses												6556.6158 (238)

10a. Fuel costs - using BEDF prices (440)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5375.6415	3.9200	210.7251 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2217.2853	3.9200	86.9176 (247)
Mechanical ventilation fans	139.1418	16.9600	23.5985 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	573.7068	16.9600	97.3007 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			209.8844 (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	5375.6415	0.2160	1161.1386 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2217.2853	0.2160	478.9336 (264)
Space and water heating			1640.0722 (265)
Pumps and fans	214.1418	0.5190	111.1396 (267)
Energy for lighting	573.7068	0.5190	297.7538 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			1102.2268 (272)

13a. Primary energy - Individual heating systems including micro-CHP

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Energy kWh/year	Primary energy factor kg CO ₂ /kWh	Primary energy kWh/year
Space heating - main system 1	5375.6415	1.2200	6558.2826 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2217.2853	1.2200	2705.0880 (264)
Space and water heating			9263.3707 (265)
Pumps and fans	214.1418	3.0700	657.4155 (267)
Energy for lighting	573.7068	3.0700	1761.2798 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			6081.8959 (272)
Primary energy kWh/m ² /year			31.7460 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North West
Overshading	Average or unknown
Thermal mass parameter	132.9 (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	651.07 (P1)
Transmission heat loss coefficient	118.40 (37)
Summer heat loss coefficient	769.47 (P2)

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

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

[Jul]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	6.0100	98.8453	0.4600	0.0000	0.9000	245.9409
South East	8.3800	119.9223	0.4600	0.0000	0.9000	416.0490
South West	3.6700	119.9223	0.4600	0.0000	0.9000	182.2076
North West	14.2100	98.8453	0.4600	0.0000	0.9000	581.5008
South East	7.3500	119.9223	0.4300	0.0000	0.9000	341.1131

total: 1766.8114

Solar gains	Jun 1879	Jul 1767	Aug 1553	(P4)
Internal gains	681	654	665	
Total summer gains	2561	2421	2218	(P5)

Summer gain/loss ratio	3.33	3.15	2.88	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 132.9)	1.07	1.07	1.07	
Threshold temperature	20.40	22.12	21.75	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	

Assessment of likelihood of high internal temperature: Medium