

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X307 Det				Issued on Date	15/12/2022
Assessment Reference	X307 Det	Prop Type Ref	Spruce			
Property	3 Bed, K, WC, U, B, En					
SAP Rating	86 B	DER	14.18	TER	18.21	
Environmental	88 B	% DER<TER	22.12			
CO ₂ Emissions (t/year)	1.22	DFEE	46.17	TFEE	58.56	
General Requirements Compliance	Pass	% DFEE<TFEE	21.15			
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 102 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.21 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.18 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.2 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)	0.09 (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 COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation

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

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average
Windows facing North: 1.45 m², No overhang
Windows facing East: 9.57 m², No overhang
Windows facing South: 3.61 m², No overhang
Windows facing West: 9.25 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 0.027 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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (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)			19.8400	1.1450	22.7176		(27)
French Door (Uw = 1.40)			4.0400	1.3258	5.3561		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.0800	0.1100	5.6188	75.0000	3831.0000 (28a)
100mm Knauf Supafil 34	142.9700	27.9400	115.0300	0.2500	28.7575	52.8000	6073.5840 (29a)
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.0900	4.5972	9.0000	459.7200 (30)
Total net area of external elements Aum(A, m ²)			245.1300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.6801		(33)
1F Timber			99.0100			9.0000	891.0900 (32c)
GF Masonry			53.8700			39.0000	2100.9300 (32c)
GF Timber			31.0500			9.0000	279.4500 (32c)
Internal Floor			51.0800			12.6000	643.6080 (32d)
Internal Ceiling			51.0800			9.0000	459.7200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14739.1020 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							144.2747 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5521 (36)
Total fabric heat loss						(33) + (36) =	78.2322 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.2524	Feb 40.8435	Mar 40.7925	Apr 40.7925	May 40.7925	Jun 40.7925	Jul 40.7925	Aug 40.7925	Sep 40.7925	Oct 40.7925	Nov 40.7925	Dec 40.7925 (38)
Heat transfer coeff	119.4847	119.0757	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247 (39)
Average = Sum(39)m / 12 =												119.0673 (39)
HLP	Jan 1.1696	Feb 1.1656	Mar 1.1651	Apr 1.1651	May 1.1651	Jun 1.1651	Jul 1.1651	Aug 1.1651	Sep 1.1651	Oct 1.1651	Nov 1.1651	Dec 1.1651 (40)
HLP (average)												1.1655 (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	2.7586 (42)
Average daily hot water use (litres/day)	99.7177 (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	109.6895	105.7008	101.7121	97.7234	93.7347	89.7460	89.7460	93.7347	97.7234	101.7121	105.7008	109.6895	(44)
Energy conte	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	98.2028	112.6892	114.0350	132.8969	145.0673	157.5337	(45)
Energy content (annual)	Total = Sum (45)m = 1568.9484												(45)
Distribution loss (46)m = 0.15 x (45)m	24.4000	21.3404	22.0213	19.1987	18.4216	15.8965	14.7304	16.9034	17.1053	19.9345	21.7601	23.6301	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1470	12.7667	14.1089	13.6130	14.0328	13.5411	13.9681	14.0101	13.5803	14.0755	13.6610	14.1346	(61)
Total heat required for water heating calculated for each month	176.8133	155.0358	160.9178	141.6046	136.8438	119.5176	112.1709	126.6993	127.6153	146.9724	158.7283	171.6683	(62)
WWHRS	-50.8004	-44.6985	-45.6202	-37.5307	-34.8458	-28.7445	-24.3246	-29.4524	-30.3129	-37.4757	-43.4148	-49.1018	eq. (G10)
Total of WWHRS savings	-456.3222												
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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665	(64)
Heat gains from water heating, kWh/month	57.6233	50.4961	52.3412	45.9604	44.3429	38.6225	36.1445	40.9717	41.3117	47.7071	51.6501	55.9136	(65)
Total per year (kWh/year) = Sum (64)m =	1278.2652												(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	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1590	20.5696	16.7283	12.6644	9.4668	7.9923	8.6359	11.2253	15.0666	19.1305	22.3281	23.8026	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.7731	262.4688	255.6759	241.2146	222.9598	205.8029	194.3410	191.6454	198.4383	212.8996	231.1543	248.3113	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	(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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	(71)
Water heating gains (Table 5)	77.4507	75.1431	70.3511	63.8340	59.6006	53.6423	48.5813	55.0695	57.3774	64.1224	71.7363	75.1527	(72)
Total internal gains	427.7624	425.5611	410.1349	385.0926	359.4068	334.8171	318.9378	325.3197	338.2618	363.5321	392.5983	414.6462	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North					1.4500	10.6334	0.4600	0.0000			0.7700	5.4612 (74)	
East					9.5700	19.6403	0.4600	0.0000			0.7700	66.5745 (76)	
South					3.6100	46.7521	0.4600	0.0000			0.7700	59.7801 (78)	
West					5.2100	19.6403	0.4600	0.0000			0.7700	36.2438 (80)	
West					4.0400	19.6403	0.4300	0.0000			0.7700	26.2717 (80)	
Solar gains	194.3312	360.8684	558.3238	775.9697	928.5812	943.3601	900.8975	786.8308	635.2814	417.6675	238.5569	162.3655	(83)
Total gains	622.0937	786.4294	968.4586	1161.0623	1287.9881	1278.1772	1219.8353	1112.1505	973.5432	781.1996	631.1552	577.0118	(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	34.2654	34.3831	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978
alpha	3.2844	3.2922	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932
util living area	0.9849	0.9679	0.9286	0.8420	0.7060	0.5469	0.4138	0.4669	0.6982	0.9059	0.9737	0.9881 (86)
MIT	19.1007	19.4105	19.8632	20.3638	20.7282	20.9137	20.9739	20.9611	20.8053	20.2709	19.5698	19.0340 (87)
Th 2	19.9444	19.9476	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480 (88)
util rest of house	0.9819	0.9616	0.9146	0.8124	0.6545	0.4715	0.3211	0.3699	0.6265	0.8810	0.9674	0.9856 (89)
MIT 2	17.4125	17.8619	18.5080	19.1991	19.6687	19.8798	19.9343	19.9259	19.7746	19.0931	18.0976	17.3179 (90)
Living area fraction	17.7161	18.1403	18.7517	19.4086	19.8592	20.0657	20.1213	20.1121	fLA = Living area / (4) =	19.9599	19.3049	18.3623 (91)
MIT	17.7161	18.1403	18.7517	19.4086	19.8592	20.0657	20.1213	20.1121	19.9599	19.3049	18.3623	17.6265 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5661	17.9903	18.6017	19.2586	19.7092	19.9157	19.9713	19.9621	19.8099	19.1549	18.2123	17.4765 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	604.2579	743.1589	863.5218	916.7228	826.4960	599.5480	394.2885	412.8431	599.7207	669.3660	601.0337	563.5607	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1585.0929	1558.7403	1440.4028	1232.9245	953.2916	632.7011	401.2659	423.9753	679.6209	1018.2417	1322.6376	1580.2291	(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)

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Space heating kWh	729.7413	548.0707	429.1995	227.6652	94.3359	0.0000	0.0000	0.0000	0.0000	259.5635	519.5548	756.4013 (98)
Space heating												3564.5322 (98)
Space heating per m2												(98) / (4) = 34.8917 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3938.7096 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	729.7413	548.0707	429.1995	227.6652	94.3359	0.0000	0.0000	0.0000	0.0000	259.5635	519.5548	756.4013 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	806.3439	605.6030	474.2536	251.5638	104.2386	0.0000	0.0000	0.0000	0.0000	286.8105	574.0937	835.8025 (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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665 (64)
Efficiency of water heater	90.0141	89.9475	89.8030	89.4711	88.8088	87.3000	87.3000	87.3000	87.3000	89.5264	89.9015	87.3000 (216)
(217)m	90.0141	89.9475	89.8030	89.4711	88.8088	87.3000	87.3000	87.3000	87.3000	89.5264	89.9015	90.0398 (217)
Fuel for water heating, kWh/month	139.9924	122.6686	128.3895	116.3212	114.8512	103.9784	100.6258	111.3939	111.4576	122.3066	128.2666	136.1249 (219)
Water heating fuel used												1436.3765 (219)
Annual totals kWh/year												
Space heating fuel - main system												3938.7096 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.4457 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.4457 (231)
Electricity for lighting (calculated in Appendix L)												408.9946 (232)
Total delivered energy for all uses												5928.5263 (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	3938.7096	0.2160	850.7613 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1436.3765	0.2160	310.2573 (264)
Space and water heating			1161.0186 (265)
Pumps and fans	144.4457	0.5190	74.9673 (267)
Energy for lighting	408.9946	0.5190	212.2682 (268)
Total CO2, kg/year			1448.2541 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1800 (273)

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

DER			14.1800 ZC1
Total Floor Area		TFA	102.1600
Assumed number of occupants		N	2.7586
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			15.0681 ZC2
CO2 emissions from cooking, equation (L16)			1.8129 ZC3
Total CO2 emissions			31.0611 ZC4
Residual CO2 emissions offset from biofuel CHP			0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year			0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation			0.0000 ZC7
Net CO2 emissions			31.0611 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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (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) = 0.1618 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4118 (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) =	0.4118 (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	0.5250	0.5147	0.5044	0.4530	0.4427	0.3912	0.3912	0.3809	0.4118	0.4427	0.4633	0.4839 (22b)
Effective ac	0.6378	0.6325	0.6272	0.6026	0.5980	0.5765	0.5765	0.5725	0.5848	0.5980	0.6073	0.6171 (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 Semi-glazed door			1.9100	1.2000	2.2920		(26a)
TER Opening Type (Uw = 1.40)			21.4700	1.3258	28.4640		(27)
FP McCann System			51.0800	0.1300	6.6404		(28a)
100mm Knauf Supafil 34	142.9700	25.5300	117.4400	0.1800	21.1392		(29a)
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.1300	6.6404		(30)
Total net area of external elements Aum, m ²			245.1300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.3260		(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)							12.1142 (36)
Total fabric heat loss						(33) + (36) =	79.4402 (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	52.0375	51.6009	51.1729	49.1625	48.7864	47.0354	47.0354	46.7112	47.7099	48.7864	49.5473	50.3428 (38)
Heat transfer coeff	131.4778	131.0411	130.6131	128.6027	128.2266	126.4756	126.4756	126.1514	127.1501	128.2266	128.9875	129.7830 (39)
Average = Sum(39)m / 12 =												128.6009 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2870	1.2827	1.2785	1.2588	1.2552	1.2380	1.2380	1.2348	1.2446	1.2552	1.2626	1.2704 (40)
HLP (average)												1.2588 (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												2.7586 (42)
Average daily hot water use (litres/day)												99.7177 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6895	105.7008	101.7121	97.7234	93.7347	89.7460	89.7460	93.7347	97.7234	101.7121	105.7008	109.6895 (44)
Energy conte	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	105.9765	112.6892	114.0350	132.8969	145.0673	157.5337 (45)
Energy content (annual)										Total = Sum(45)m =		1568.9484 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4000	21.3404	22.0213	19.1987	18.4216	15.8965	14.7304	16.9034	17.1053	19.9345	21.7601	23.6301 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	48.1924	47.7662	44.2583	45.7336	47.7662	48.1924	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	213.6253	188.2965	197.7678	176.1839	170.5771	150.2348	143.9364	160.4553	162.2274	183.8558	194.3824	208.4926 (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	213.6253	188.2965	197.7678	176.1839	170.5771	150.2348	143.9364	160.4553	162.2274	183.8558	194.3824	208.4926 (64)
Heat gains from water heating, kWh/month	66.8263	58.8113	61.5537	54.6053	52.7762	46.3018	44.0858	49.4107	49.9647	56.9279	60.5636	65.1197 (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	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.2212	20.6249	16.7733	12.6985	9.4923	8.0138	8.6591	11.2555	15.1071	19.1819	22.3881	23.8666 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.7731	262.4688	255.6759	241.2146	222.9598	205.8029	194.3410	191.6454	198.4383	212.8996	231.1543	248.3113 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932 (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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457 (71)
Water heating gains (Table 5)	89.8203	87.5168	82.7335	75.8407	70.9357	64.3080	59.2552	66.4122	69.3955	76.5160	84.1162	87.5265 (72)
Total internal gains	440.1943	437.9901	422.5623	397.1333	370.7674	345.5043	329.6349	336.6927	350.3205	375.9771	405.0383	427.0840 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.3000	10.6334	0.6300	0.7000	0.7700	4.2246 (74)			
East				8.6000	19.6403	0.6300	0.7000	0.7700	51.6200 (76)			
South				3.2500	46.7521	0.6300	0.7000	0.7700	46.4361 (78)			
West				8.3200	19.6403	0.6300	0.7000	0.7700	49.9393 (80)			
Solar gains	152.2200	282.7953	437.7771	608.7031	728.5784	740.2247	706.8862	617.2902	498.2195	327.3783	186.8867	127.1643 (83)
Total gains	592.4143	720.7854	860.3393	1005.8364	1099.3458	1085.7290	1036.5211	953.9829	848.5400	703.3554	591.9250	554.2483 (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	53.9593	54.1391	54.3165	55.1656	55.3274	56.0934	56.0934	56.2375	55.7958	55.3274	55.0010	54.6639
alpha	4.5973	4.6093	4.6211	4.6777	4.6885	4.7396	4.7396	4.7492	4.7197	4.6885	4.6667	4.6443
util living area	0.9982	0.9953	0.9856	0.9499	0.8560	0.6876	0.5235	0.5844	0.8386	0.9758	0.9962	0.9987 (86)
MIT	19.5611	19.7502	20.0605	20.4585	20.7731	20.9431	20.9874	20.9794	20.8502	20.4162	19.9161	19.5365 (87)
Th 2	19.8510	19.8544	19.8577	19.8732	19.8761	19.8897	19.8897	19.8922	19.8845	19.8761	19.8702	19.8641 (88)
util rest of house	0.9976	0.9937	0.9803	0.9310	0.8041	0.5908	0.3982	0.4554	0.7615	0.9634	0.9946	0.9983 (89)
MIT 2	17.9415	18.2197	18.6719	19.2464	19.6589	19.8531	19.8853	19.8841	19.7662	19.1999	18.4737	17.9146 (90)
Living area fraction									fLA = Living area / (4) =			0.1798 (91)
MIT	18.2327	18.4949	18.9216	19.4643	19.8593	20.0491	20.0835	20.0811	19.9612	19.4186	18.7331	18.2062 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2327	18.4949	18.9216	19.4643	19.8593	20.0491	20.0835	20.0811	19.9612	19.4186	18.7331	18.2062 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9962	0.9907	0.9742	0.9223	0.8032	0.6057	0.4208	0.4785	0.7677	0.9563	0.9921	0.9972 (94)
Ext temp.	590.1763	714.1175	838.1635	927.6527	882.9945	657.6626	436.1530	456.4430	651.4316	672.5901	587.2326	552.6973 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1831.8385	1781.4951	1622.4226	1358.6029	1046.2354	689.1836	440.5774	464.3718	745.2457	1130.7780	1500.5184	1817.7701 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	923.7967	717.2778	583.4887	310.2842	121.4512	0.0000	0.0000	0.0000	0.0000	340.8918	657.5658	941.2142 (98)
Space heating per m2												4595.9704 (98)
										(98) / (4) =		44.9880 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4920.7392 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	923.7967	717.2778	583.4887	310.2842	121.4512	0.0000	0.0000	0.0000	0.0000	340.8918	657.5658	941.2142	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	989.0757	767.9634	624.7203	332.2100	130.0334	0.0000	0.0000	0.0000	0.0000	364.9805	704.0319	1007.7240	(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	213.6253	188.2965	197.7678	176.1839	170.5771	150.2348	143.9364	160.4553	162.2274	183.8558	194.3824	208.4926	(64)
Efficiency of water heater (217)m	88.3138	88.0960	87.6105	86.4614	84.2130	80.3000	80.3000	80.3000	80.3000	86.5843	87.8781	80.3000	(216)
Fuel for water heating, kWh/month	241.8936	213.7400	225.7353	203.7717	202.5544	187.0919	179.2483	199.8199	202.0267	212.3430	221.1955	235.8940	(219)
Water heating fuel used												2525.3143	(219)
Annual totals kWh/year													
Space heating fuel - main system												4920.7392	(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)												410.0944	(232)
Total delivered energy for all uses												7931.1479	(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	4920.7392	0.2160	1062.8797 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2525.3143	0.2160	545.4679 (264)
Space and water heating			1608.3475 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	410.0944	0.5190	212.8390 (268)
Total CO2, kg/m2/year			1860.1116 (272)
Emissions per m2 for space and water heating			15.7434 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0834 (272b)
Emissions per m2 for pumps and fans			0.3810 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.7434 * 1.00) + 2.0834 + 0.3810, rounded to 2 d.p.			18.2100 (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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (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) = 0.1618 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3623 (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) =	0.3623 (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	0.4619	0.4529	0.4438	0.3985	0.3895	0.3442	0.3442	0.3351	0.3623	0.3895	0.4076	0.4257 (22b)
Effective ac	0.6067	0.6025	0.5985	0.5794	0.5758	0.5592	0.5592	0.5562	0.5656	0.5758	0.5831	0.5906 (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)			19.8400	1.1450	22.7176		(27)
French Door (Uw = 1.40)			4.0400	1.3258	5.3561		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.0800	0.1100	5.6188	75.0000	3831.0000 (28a)
100mm Knauf Supafil 34	142.9700	27.9400	115.0300	0.2500	28.7575	52.8000	6073.5840 (29a)
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.0900	4.5972	9.0000	459.7200 (30)
Total net area of external elements Aum(A, m ²)			245.1300				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	71.6801		(33)
1F Timber			99.0100			9.0000	891.0900 (32c)
GF Masonry			53.8700			39.0000	2100.9300 (32c)
GF Timber			31.0500			9.0000	279.4500 (32c)
Internal Floor			51.0800			12.6000	643.6080 (32d)
Internal Ceiling			51.0800			9.0000	459.7200 (32e)

Heat capacity Cm = Sum(A x k)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 14739.1020 (34)
144.2747 (35)
6.5521 (36)
(33) + (36) = 78.2322 (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	49.4966	49.1586	48.8273	47.2712	46.9801	45.6248	45.6248	45.3738	46.1468	46.9801	47.5690	48.1848 (38)
Heat transfer coeff	127.7288	127.3908	127.0596	125.5035	125.2123	123.8570	123.8570	123.6060	124.3790	125.2123	125.8013	126.4170 (39)
Average = Sum(39)m / 12 =												125.5021 (39)
HLP	1.2503	1.2470	1.2437	1.2285	1.2256	1.2124	1.2124	1.2099	1.2175	1.2256	1.2314	1.2374 (40)
HLP (average)												1.2285 (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												2.7586 (42)
Average daily hot water use (litres/day)												99.7177 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.6895	105.7008	101.7121	97.7234	93.7347	89.7460	89.7460	93.7347	97.7234	101.7121	105.7008	109.6895 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	98.2028	112.6892	114.0350	132.8969	145.0673	157.5337 (45)
Energy content (annual)										Total =	Sum (45)m =	1568.9484 (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	34.5666	30.2322	31.1969	27.1982	26.0973	22.5200	20.8681	23.9465	24.2324	28.2406	30.8268	33.4759 (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	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.1590	20.5696	16.7283	12.6644	9.4668	7.9923	8.6359	11.2253	15.0666	19.1305	22.3281	23.8026 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.7731	262.4688	255.6759	241.2146	222.9598	205.8029	194.3410	191.6454	198.4383	212.8996	231.1543	248.3113 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932 (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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457 (71)
Water heating gains (Table 5)	46.4605	44.9884	41.9313	37.7753	35.0771	31.2778	28.0485	32.1861	33.6562	37.9578	42.8150	44.9945 (72)
Total internal gains	393.7722	392.4063	378.7151	356.0339	331.8833	309.4526	295.4051	299.4364	311.5406	334.3674	360.6771	381.4880 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.4500	10.6334	0.4600	0.0000	0.7700	5.4612 (74)
East	9.5700	19.6403	0.4600	0.0000	0.7700	66.5745 (76)
South	3.6100	46.7521	0.4600	0.0000	0.7700	59.7801 (78)
West	5.2100	19.6403	0.4600	0.0000	0.7700	36.2438 (80)
West	4.0400	19.6403	0.4300	0.0000	0.7700	26.2717 (80)

Solar gains	194.3312	360.8684	558.3238	775.9697	928.5812	943.3601	900.8975	786.8308	635.2814	417.6675	238.5569	162.3655 (83)
Total gains	588.1035	753.2747	937.0389	1132.0036	1260.4645	1252.8126	1196.3026	1086.2672	946.8220	752.0349	599.2340	543.8535 (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	32.0538	32.1388	32.2226	32.6222	32.6980	33.0558	33.0558	33.1229	32.9171	32.6980	32.5449	32.3864
alpha	3.1369	3.1426	3.1482	3.1748	3.1799	3.2037	3.2037	3.2082	3.1945	3.1799	3.1697	3.1591
util living area	0.9872	0.9724	0.9377	0.8583	0.7298	0.5699	0.4348	0.4900	0.7229	0.9180	0.9777	0.9899 (86)
MIT	18.9133	19.2262	19.7025	20.2604	20.6691	20.8932	20.9663	20.9506	20.7644	20.1722	19.4292	18.8617 (87)
Th 2	19.8800	19.8826	19.8852	19.8973	19.8995	19.9101	19.9101	19.9121	19.9060	19.8995	19.8950	19.8902 (88)
util rest of house	0.9845	0.9667	0.9249	0.8298	0.6779	0.4911	0.3353	0.3867	0.6505	0.8949	0.9722	0.9878 (89)
MIT 2	17.9834	18.2945	18.7622	19.3012	19.6665	19.8524	19.8981	19.8930	19.7620	19.2347	18.5075	17.9395 (90)
Living area fraction	18.1506	18.4621	18.9313	19.4737	19.8468	20.0396	20.0902	20.0832	19.9422	19.4032	18.6732	18.1053 (92)
Temperature adjustment	18.1506	18.4621	18.9313	19.4737	19.8468	20.0396	20.0902	20.0832	19.9422	19.4032	18.6732	18.1053 (93)
adjusted MIT	18.1506	18.4621	18.9313	19.4737	19.8468	20.0396	20.0902	20.0832	19.9422	19.4032	18.6732	18.1053 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9787	0.9571	0.9112	0.8171	0.6751	0.5010	0.3524	0.4038	0.6532	0.8819	0.9638	0.9829 (94)
Ext temp.	575.5681	720.9552	853.8483	924.9205	850.9917	627.6507	421.5512	438.5885	618.4463	663.2306	577.5521	534.5540 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1769.1230	1727.6827	1579.5092	1327.0307	1020.0759	673.7305	432.2868	455.2621	726.6523	1102.2739	1455.9255	1757.8684 (97)
Space heating kWh	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	888.0048	676.5208	539.8918	289.5194	125.7986	0.0000	0.0000	0.0000	0.0000	326.6482	632.4288	910.1459 (98)
Space heating per m2												4388.9583 (98)
										(98) / (4) =		42.9616 (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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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	1164.2558	916.5418	939.4057	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8615	0.9085	0.8832	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1003.0025	832.6369	829.7233	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1570.5389	1502.1800	1375.4429	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	408.6263	498.1400	406.0154	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling													
Cooled fraction									FC = cooled area / (4) =			1312.7816	(104)
Intermittency factor (Table 10b)												1.0000	(105)
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	102.1566	124.5350	101.5038	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling													
Space cooling per m2												328.1954	(107)
Energy for space heating												3.2126	(108)
Energy for space cooling												42.9616	(99)
Total												3.2126	(108)
Dwelling Fabric Energy Efficiency (DFEE)												46.1742	(109)
												46.2	(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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (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) = 0.1618 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4118 (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) =	0.4118 (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												
Effective ac	0.5250	0.5147	0.5044	0.4530	0.4427	0.3912	0.3912	0.3809	0.4118	0.4427	0.4633	0.4839 (22b)
	0.6378	0.6325	0.6272	0.6026	0.5980	0.5765	0.5765	0.5725	0.5848	0.5980	0.6073	0.6171 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
TER Opaque door			2.1500	1.0000	2.1500			(26)					
TER Semi-glazed door			1.9100	1.2000	2.2920			(26a)					
TER Opening Type (Uw = 1.40)			21.4700	1.3258	28.4640			(27)					
FP McCann System			51.0800	0.1300	6.6404			(28a)					
100mm Knauf Supafil 34	142.9700	25.5300	117.4400	0.1800	21.1392			(29a)					
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.1300	6.6404			(30)					
Total net area of external elements Aum(A, m2)			245.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	67.3260			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.1142	(36)					
Total fabric heat loss						(33) + (36) =	79.4402	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 52.0375	Feb 51.6009	Mar 51.1729	Apr 49.1625	May 48.7864	Jun 47.0354	Jul 47.0354	Aug 46.7112	Sep 47.7099	Oct 48.7864	Nov 49.5473	Dec 50.3428	(38)
Heat transfer coeff	131.4778	131.0411	130.6131	128.6027	128.2266	126.4756	126.4756	126.1514	127.1501	128.2266	128.9875	129.7830	(39)
Average = Sum(39)m / 12 =												128.6009	(39)
HLP	Jan 1.2870	Feb 1.2827	Mar 1.2785	Apr 1.2588	May 1.2552	Jun 1.2380	Jul 1.2380	Aug 1.2348	Sep 1.2446	Oct 1.2552	Nov 1.2626	Dec 1.2704	(40)
HLP (average)												1.2588	(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												2.7586 (42)
Average daily hot water use (litres/day)												99.7177 (43)
Daily hot water use	Jan 109.6895	Feb 105.7008	Mar 101.7121	Apr 97.7234	May 93.7347	Jun 89.7460	Jul 89.7460	Aug 93.7347	Sep 97.7234	Oct 101.7121	Nov 105.7008	Dec 109.6895 (44)
Energy conte	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	98.2028	112.6892	114.0350	132.8969	145.0673	157.5337 (45)
Energy content (annual)										Total = Sum(45)m =		1568.9484 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	34.5666	30.2322	31.1969	27.1982	26.0973	22.5200	20.8681	23.9465	24.2324	28.2406	30.8268	33.4759 (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	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	137.9321	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	23.2212	20.6249	16.7733	12.6985	9.4923	8.0138	8.6591	11.2555	15.1071	19.1819	22.3881	23.8666	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	259.7731	262.4688	255.6759	241.2146	222.9598	205.8029	194.3410	191.6454	198.4383	212.8996	231.1543	248.3113	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	36.7932	(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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	(71)
Water heating gains (Table 5)	46.4605	44.9884	41.9313	37.7753	35.0771	31.2778	28.0485	32.1861	33.6562	37.9578	42.8150	44.9945	(72)
Total internal gains	393.8345	392.4617	378.7601	356.0680	331.9087	309.4740	295.4283	299.4666	311.5812	334.4189	360.7371	381.5520	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.3000	10.6334	0.6300	0.7000	0.7700	4.2246	(74)
East	8.6000	19.6403	0.6300	0.7000	0.7700	51.6200	(76)
South	3.2500	46.7521	0.6300	0.7000	0.7700	46.4361	(78)
West	8.3200	19.6403	0.6300	0.7000	0.7700	49.9393	(80)

Solar gains	152.2200	282.7953	437.7771	608.7031	728.5784	740.2247	706.8862	617.2902	498.2195	327.3783	186.8867	127.1643	(83)
Total gains	546.0545	675.2570	816.5372	964.7710	1060.4871	1049.6988	1002.3145	916.7568	809.8007	661.7972	547.6238	508.7164	(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	53.9593	54.1391	54.3165	55.1656	55.3274	56.0934	56.0934	56.2375	55.7958	55.3274	55.0010	54.6639	
alpha	4.5973	4.6093	4.6211	4.6777	4.6885	4.7396	4.7396	4.7492	4.7197	4.6885	4.6667	4.6443	
util living area	0.9987	0.9964	0.9882	0.9565	0.8689	0.7047	0.5395	0.6045	0.8565	0.9808	0.9973	0.9991	(86)
MIT	19.5198	19.7102	20.0236	20.4291	20.7555	20.9369	20.9857	20.9763	20.8339	20.3826	19.8768	19.4958	(87)
Th 2	19.8510	19.8544	19.8577	19.8732	19.8761	19.8897	19.8897	19.8922	19.8845	19.8761	19.8702	19.8641	(88)
util rest of house	0.9983	0.9952	0.9838	0.9396	0.8194	0.6078	0.4113	0.4727	0.7832	0.9706	0.9961	0.9988	(89)
MIT 2	18.5061	18.6986	19.0121	19.4183	19.7143	19.8616	19.8863	19.8858	19.7930	19.3826	18.8778	18.4924	(90)
Living area fraction									fLA = Living area / (4) =			0.1798	(91)
MIT	18.6884	18.8805	19.1940	19.6001	19.9015	20.0550	20.0840	20.0819	19.9802	19.5624	19.0574	18.6728	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6884	18.8805	19.1940	19.6001	19.9015	20.0550	20.0840	20.0819	19.9802	19.5624	19.0574	18.6728	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9976	0.9936	0.9804	0.9345	0.8207	0.6234	0.4346	0.4965	0.7907	0.9667	0.9948	0.9983	(94)
Ext temp.	544.7695	670.9571	800.5374	901.5820	870.3867	654.3725	435.5703	455.2130	640.3001	639.7310	544.8016	507.8555	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1891.7538	1832.0206	1658.0024	1376.0576	1051.6548	689.9223	440.6380	464.4708	747.6649	1149.2197	1542.3587	1878.3274	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(97a)
Space heating per m2	1002.1563	780.2347	637.9540	341.6224	134.8635	0.0000	0.0000	0.0000	0.0000	379.0596	718.2411	1019.6310	(98)
												5013.7626	(98)
												49.0776	(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	1188.8710	935.9197	958.7505	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8695	0.9261	0.8990	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1033.7010	866.7634	861.9001	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1333.1617	1275.4716	1177.3540	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	215.6117	304.0789	234.6977	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			754.3884 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	53.9029	76.0197	58.6744	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												188.5971 (107)
Energy for space heating												1.8461 (108)
Energy for space cooling												49.0776 (99)
Total												1.8461 (108)
Target Fabric Energy Efficiency (TFEE)												50.9236 (109)
												58.6 (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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (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
Wind factor	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)
Adj infilt rate	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)
	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)			19.8400	1.1450	22.7176		(27)
French Door (Uw = 1.40)			4.0400	1.3258	5.3561		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.0800	0.1100	5.6188	75.0000	3831.0000 (28a)
100mm Knauf Supafil 34	142.9700	27.9400	115.0300	0.2500	28.7575	52.8000	6073.5840 (29a)
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.0900	4.5972	9.0000	459.7200 (30)
Total net area of external elements Aum(A, m ²)			245.1300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.6801		(33)
1F Timber			99.0100			9.0000	891.0900 (32c)
GF Masonry			53.8700			39.0000	2100.9300 (32c)
GF Timber			31.0500			9.0000	279.4500 (32c)
Internal Floor			51.0800			12.6000	643.6080 (32d)
Internal Ceiling			51.0800			9.0000	459.7200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14739.1020 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							144.2747 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5521 (36)
Total fabric heat loss					(33) + (36) =		78.2322 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 40.7925	Feb 40.7925	Mar 40.7925	Apr 40.7925	May 40.7925	Jun 40.7925	Jul 40.7925	Aug 40.7925	Sep 40.7925	Oct 40.7925	Nov 40.7925	Dec 40.7925 (38)
Heat transfer coeff	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247 (39)
Average = Sum(39)m / 12 =												119.0247 (39)
HLP	Jan 1.1651	Feb 1.1651	Mar 1.1651	Apr 1.1651	May 1.1651	Jun 1.1651	Jul 1.1651	Aug 1.1651	Sep 1.1651	Oct 1.1651	Nov 1.1651	Dec 1.1651 (40)
HLP (average)												1.1651 (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	2.7586 (42)
Average daily hot water use (litres/day)	99.7177 (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	109.6895	105.7008	101.7121	97.7234	93.7347	89.7460	89.7460	93.7347	97.7234	101.7121	105.7008	109.6895	(44)
Energy conte	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	98.2028	112.6892	114.0350	132.8969	145.0673	157.5337	(45)
Energy content (annual)										Total =	Sum (45)m =	1568.9484	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4000	21.3404	22.0213	19.1987	18.4216	15.8965	14.7304	16.9034	17.1053	19.9345	21.7601	23.6301	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1470	12.7667	14.1089	13.6130	14.0328	13.5411	13.9681	14.0101	13.5803	14.0755	13.6610	14.1346	(61)
Total heat required for water heating calculated for each month	176.8133	155.0358	160.9178	141.6046	136.8438	119.5176	112.1709	126.6993	127.6153	146.9724	158.7283	171.6683	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) =										Sum (63)m =		0.0000	(63)
Output from w/h	176.8133	155.0358	160.9178	141.6046	136.8438	119.5176	112.1709	126.6993	127.6153	146.9724	158.7283	171.6683	(64)
RHI water heating demand										Total per year (kWh/year) =	Sum (64)m =	1734.5874	(64)
Heat gains from water heating, kWh/month	57.6233	50.4961	52.3412	45.9604	44.3429	38.6225	36.1445	40.9717	41.3117	47.7071	51.6501	55.9136	(65)
												1735	(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	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8974	51.4240	41.8208	31.6610	23.6670	19.9807	21.5898	28.0633	37.6664	47.8262	55.8202	59.5066	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.7211	391.7444	381.6058	360.0218	332.7758	307.1685	290.0612	286.0378	296.1765	317.7605	345.0065	370.6138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	(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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	(71)
Water heating gains (Table 5)	77.4507	75.1431	70.3511	63.8340	59.6006	53.6423	48.5813	55.0695	57.3774	64.1224	71.7363	75.1527	(72)
Total internal gains	635.5525	630.7948	606.2610	568.0001	528.5267	493.2748	472.7156	481.6539	503.7037	542.1925	585.0463	617.7564	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W
North					1.4500	11.9814		0.4600	0.0000	0.7700		6.1535 (74)
East					9.5700	22.3313		0.4600	0.0000	0.7700		75.6963 (76)
South					3.6100	50.9848		0.4600	0.0000	0.7700		65.1924 (78)
West					5.2100	22.3313		0.4600	0.0000	0.7700		41.2098 (80)
West					4.0400	22.3313		0.4300	0.0000	0.7700		29.8714 (80)

Solar gains	218.1234	364.7703	557.8711	799.3391	932.2057	1013.6915	957.5105	854.9353	688.1742	450.9091	274.3871	180.4363 (83)
Total gains	853.6759	995.5651	1164.1320	1367.3391	1460.7324	1506.9663	1430.2261	1336.5892	1191.8778	993.1016	859.4334	798.1927 (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	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978
alpha	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932
util living area	0.9588	0.9340	0.8748	0.7537	0.5859	0.3835	0.2558	0.2817	0.5346	0.8105	0.9303	0.9655 (86)
MIT	19.5229	19.7579	20.1742	20.6004	20.8675	20.9763	20.9956	20.9940	20.9268	20.5683	19.9715	19.4571 (87)
Th 2	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480 (88)
util rest of house	0.9508	0.9218	0.8522	0.7134	0.5248	0.3072	0.1700	0.1906	0.4519	0.7673	0.9149	0.9586 (89)
MIT 2	18.0230	18.3565	18.9379	19.5037	19.8265	19.9339	19.9468	19.9462	19.8946	19.4814	18.6672	17.9294 (90)
Living area fraction									fLA = Living area / (4) =			0.1798 (91)
MIT	18.2927	18.6085	19.1603	19.7009	20.0137	20.1214	20.1354	20.1346	20.0802	19.6769	18.9017	18.2041 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1427	18.4585	19.0103	19.5509	19.8637	19.9714	19.9854	19.9846	19.9302	19.5269	18.7517	18.0541 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9320	0.8993	0.8281	0.6964	0.5196	0.3089	0.1731	0.1938	0.4504	0.7470	0.8919	0.9414	(94)
Useful gains	795.6009	895.3106	963.9815	952.2281	759.0512	465.5127	247.5754	259.0710	536.8349	741.8954	766.5457	751.3862	(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)
Heat loss rate W	1552.4068	1530.4768	1381.9072	1148.6997	816.9453	472.6890	248.2174	260.0261	563.0116	943.4932	1279.7238	1541.8585	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

	563.0636	426.8316	310.9367	141.4595	43.0732	0.0000	0.0000	0.0000	0.0000	149.9888	369.4882	588.1114 (98)
Space heating												2592.9530 (98)
RHI space heating demand												2593 (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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (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)			19.8400	1.1450	22.7176		(27)
French Door (Uw = 1.40)			4.0400	1.3258	5.3561		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.0800	0.1100	5.6188	75.0000	3831.0000 (28a)
100mm Knauf Supafil 34	142.9700	27.9400	115.0300	0.2500	28.7575	52.8000	6073.5840 (29a)
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.0900	4.5972	9.0000	459.7200 (30)
Total net area of external elements Aum(A, m ²)			245.1300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.6801		(33)
1F Timber			99.0100			9.0000	891.0900 (32c)
GF Masonry			53.8700			39.0000	2100.9300 (32c)
GF Timber			31.0500			9.0000	279.4500 (32c)
Internal Floor			51.0800			12.6000	643.6080 (32d)
Internal Ceiling			51.0800			9.0000	459.7200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14739.1020 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							144.2747 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5521 (36)
Total fabric heat loss					(33) + (36) =		78.2322 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.2524	Feb 40.8435	Mar 40.7925	Apr 40.7925	May 40.7925	Jun 40.7925	Jul 40.7925	Aug 40.7925	Sep 40.7925	Oct 40.7925	Nov 40.7925	Dec 40.7925 (38)
Heat transfer coeff	119.4847	119.0757	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247 (39)
Average = Sum(39)m / 12 =												119.0673 (39)
HLP	Jan 1.1696	Feb 1.1656	Mar 1.1651	Apr 1.1651	May 1.1651	Jun 1.1651	Jul 1.1651	Aug 1.1651	Sep 1.1651	Oct 1.1651	Nov 1.1651	Dec 1.1651 (40)
HLP (average)												1.1655 (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	2.7586 (42)
Average daily hot water use (litres/day)	99.7177 (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	109.6895	105.7008	101.7121	97.7234	93.7347	89.7460	89.7460	93.7347	97.7234	101.7121	105.7008	109.6895	(44)
Energy conte	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	98.2028	112.6892	114.0350	132.8969	145.0673	157.5337	(45)
Energy content (annual)	Total = Sum (45)m =												1568.9484 (45)
Distribution loss (46)m = 0.15 x (45)m	24.4000	21.3404	22.0213	19.1987	18.4216	15.8965	14.7304	16.9034	17.1053	19.9345	21.7601	23.6301	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1470	12.7667	14.1089	13.6130	14.0328	13.5411	13.9681	14.0101	13.5803	14.0755	13.6610	14.1346	(61)
Total heat required for water heating calculated for each month	176.8133	155.0358	160.9178	141.6046	136.8438	119.5176	112.1709	126.6993	127.6153	146.9724	158.7283	171.6683	(62)
WWHRS	-50.8004	-44.6985	-45.6202	-37.5307	-34.8458	-28.7445	-24.3246	-29.4524	-30.3129	-37.4757	-43.4148	-49.1018	eq. (G10)
Total of WWHRS savings	-456.3222												
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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665	(64)
Heat gains from water heating, kWh/month	57.6233	50.4961	52.3412	45.9604	44.3429	38.6225	36.1445	40.9717	41.3117	47.7071	51.6501	55.9136	(65)
Total per year (kWh/year) = Sum (64)m =												1278.2652	(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	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8974	51.4240	41.8208	31.6610	23.6670	19.9807	21.5898	28.0633	37.6664	47.8262	55.8202	59.5066	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.7211	391.7444	381.6058	360.0218	332.7758	307.1685	290.0612	286.0378	296.1765	317.7605	345.0065	370.6138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	(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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	(71)
Water heating gains (Table 5)	77.4507	75.1431	70.3511	63.8340	59.6006	53.6423	48.5813	55.0695	57.3774	64.1224	71.7363	75.1527	(72)
Total internal gains	635.5525	630.7948	606.2610	568.0001	528.5267	493.2748	472.7156	481.6539	503.7037	542.1925	585.0463	617.7564	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.4500	10.6334		0.4600	0.0000	0.7700		5.4612 (74)	
East					9.5700	19.6403		0.4600	0.0000	0.7700		66.5745 (76)	
South					3.6100	46.7521		0.4600	0.0000	0.7700		59.7801 (78)	
West					5.2100	19.6403		0.4600	0.0000	0.7700		36.2438 (80)	
West					4.0400	19.6403		0.4300	0.0000	0.7700		26.2717 (80)	

Solar gains	194.3312	360.8684	558.3238	775.9697	928.5812	943.3601	900.8975	786.8308	635.2814	417.6675	238.5569	162.3655	(83)
Total gains	829.8838	991.6632	1164.5847	1343.9698	1457.1080	1436.6349	1373.6131	1268.4847	1138.9851	959.8600	823.6032	780.1220	(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	34.2654	34.3831	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	
alpha	3.2844	3.2922	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	
util living area	0.9665	0.9414	0.8908	0.7929	0.6531	0.4972	0.3712	0.4158	0.6302	0.8537	0.9468	0.9720 (86)	
MIT	19.3608	19.6475	20.0531	20.4848	20.7864	20.9348	20.9811	20.9723	20.8577	20.4246	19.7971	19.2928 (87)	
Th 2	19.9444	19.9476	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480 (88)	
util rest of house	0.9601	0.9309	0.8717	0.7586	0.6004	0.4256	0.2866	0.3269	0.5577	0.8202	0.9353	0.9667 (89)	
MIT 2	17.7867	18.1980	18.7686	19.3530	19.7328	19.8976	19.9383	19.9327	19.8255	19.2927	18.4194	17.6914 (90)	
Living area fraction	fLA = Living area / (4) =												0.1798 (91)
MIT	18.0698	18.4586	18.9995	19.5565	19.9222	20.0841	20.1258	20.1197	20.0111	19.4962	18.6671	17.9793 (92)	
Temperature adjustment													-0.1500
adjusted MIT	17.9198	18.3086	18.8495	19.4065	19.7722	19.9341	19.9758	19.9697	19.8611	19.3462	18.5171	17.8293 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9432	0.9093	0.8473	0.7387	0.5909	0.4247	0.2889	0.3288	0.5512	0.7972	0.9143	0.9513	(94)
Useful gains	782.7161	901.6836	986.7813	992.8131	861.0709	610.0740	396.8180	417.1029	627.8506	765.1844	753.0135	742.1463	(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	1627.3550	1596.6423	1469.9014	1250.5351	960.7961	634.8881	401.8056	424.8793	685.7180	1041.0146	1358.9182	1622.2292	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating kWh	628.4114	467.0122	359.4413	185.5599	74.1955	0.0000	0.0000	0.0000	0.0000	205.2176	436.2514	654.7817 (98)
Space heating												3010.8710 (98)
Space heating per m2												(98) / (4) = 29.4721 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3326.9293 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	628.4114	467.0122	359.4413	185.5599	74.1955	0.0000	0.0000	0.0000	0.0000	205.2176	436.2514	654.7817 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	694.3772	516.0356	397.1727	205.0385	81.9840	0.0000	0.0000	0.0000	0.0000	226.7598	482.0458	723.5157 (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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665 (64)
Efficiency of water heater	89.9493	89.8704	89.7015	89.3235	88.6195	87.3000	87.3000	87.3000	87.3000	89.3604	89.8117	87.3000 (216)
(217)m	89.9493	89.8704	89.7015	89.3235	88.6195	87.3000	87.3000	87.3000	87.3000	89.3604	89.8117	89.9800 (217)
Fuel for water heating, kWh/month	140.0933	122.7737	128.5348	116.5134	115.0965	103.9784	100.6258	111.3939	111.4576	122.5338	128.3947	136.2154 (219)
Water heating fuel used												1437.6113 (219)
Annual totals kWh/year												
Space heating fuel - main system												3326.9293 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.4457 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.4457 (231)
Electricity for lighting (calculated in Appendix L)												408.9946 (232)
Total delivered energy for all uses												5317.9809 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3326.9293	3.4800	115.7771 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1437.6113	3.4800	50.0289 (247)
Mechanical ventilation fans	69.4457	13.1900	9.1599 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	408.9946	13.1900	53.9464 (250)
Additional standing charges			120.0000 (251)
Total energy cost			358.8048 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)		1.0240 (257)
SAP value	[(255) x (256)] / [(4) + 45.0] =	85.7146
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3326.9293	0.2160	718.6167 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1437.6113	0.2160	310.5240 (264)
Space and water heating			1029.1408 (265)
Pumps and fans	144.4457	0.5190	74.9673 (267)
Energy for lighting	408.9946	0.5190	212.2682 (268)
Total kg/year			1316.3763 (272)
CO2 emissions per m2			12.8900 (273)
EI value			88.0134
EI rating			88 (274)
EI band			B

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Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8882 = 3.918$, stars = 5
Water heating environmental impact	$0.216 / 0.8882 = 0.2432$, 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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (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
Wind factor	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)
Adj infilt rate	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)
	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)			19.8400	1.1450	22.7176		(27)
French Door (Uw = 1.40)			4.0400	1.3258	5.3561		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.0800	0.1100	5.6188	75.0000	3831.0000 (28a)
100mm Knauf Supafil 34	142.9700	27.9400	115.0300	0.2500	28.7575	52.8000	6073.5840 (29a)
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.0900	4.5972	9.0000	459.7200 (30)
Total net area of external elements Aum(A, m ²)			245.1300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.6801		(33)
1F Timber			99.0100			9.0000	891.0900 (32c)
GF Masonry			53.8700			39.0000	2100.9300 (32c)
GF Timber			31.0500			9.0000	279.4500 (32c)
Internal Floor			51.0800			12.6000	643.6080 (32d)
Internal Ceiling			51.0800			9.0000	459.7200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14739.1020 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							144.2747 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5521 (36)
Total fabric heat loss					(33) + (36) =		78.2322 (37)

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

(38)m	Jan 40.7925	Feb 40.7925	Mar 40.7925	Apr 40.7925	May 40.7925	Jun 40.7925	Jul 40.7925	Aug 40.7925	Sep 40.7925	Oct 40.7925	Nov 40.7925	Dec 40.7925 (38)
Heat transfer coeff	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247 (39)
Average = Sum(39)m / 12 =												119.0247 (39)
HLP	1.1651	1.1651	1.1651	1.1651	1.1651	1.1651	1.1651	1.1651	1.1651	1.1651	1.1651	1.1651 (40)
HLP (average)												1.1651 (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	2.7586 (42)
Average daily hot water use (litres/day)	99.7177 (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	109.6895	105.7008	101.7121	97.7234	93.7347	89.7460	89.7460	93.7347	97.7234	101.7121	105.7008	109.6895	(44)
Energy conte	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	98.2028	112.6892	114.0350	132.8969	145.0673	157.5337	(45)
Energy content (annual)	Total = Sum (45)m = 1568.9484												(45)
Distribution loss (46)m = 0.15 x (45)m	24.4000	21.3404	22.0213	19.1987	18.4216	15.8965	14.7304	16.9034	17.1053	19.9345	21.7601	23.6301	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1470	12.7667	14.1089	13.6130	14.0328	13.5411	13.9681	14.0101	13.5803	14.0755	13.6610	14.1346	(61)
Total heat required for water heating calculated for each month	176.8133	155.0358	160.9178	141.6046	136.8438	119.5176	112.1709	126.6993	127.6153	146.9724	158.7283	171.6683	(62)
WWHRS	-50.8004	-44.6985	-45.6202	-37.5307	-34.8458	-28.7445	-24.3246	-29.4524	-30.3129	-37.4757	-43.4148	-49.1018	eq. (G10)
Total of WWHRS savings	-456.3222												
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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665	(64)
Heat gains from water heating, kWh/month	57.6233	50.4961	52.3412	45.9604	44.3429	38.6225	36.1445	40.9717	41.3117	47.7071	51.6501	55.9136	(65)
Total per year (kWh/year) = Sum (64)m = 1278.2652													(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	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8974	51.4240	41.8208	31.6610	23.6670	19.9807	21.5898	28.0633	37.6664	47.8262	55.8202	59.5066	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.7211	391.7444	381.6058	360.0218	332.7758	307.1685	290.0612	286.0378	296.1765	317.7605	345.0065	370.6138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	(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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	(71)
Water heating gains (Table 5)	77.4507	75.1431	70.3511	63.8340	59.6006	53.6423	48.5813	55.0695	57.3774	64.1224	71.7363	75.1527	(72)
Total internal gains	635.5525	630.7948	606.2610	568.0001	528.5267	493.2748	472.7156	481.6539	503.7037	542.1925	585.0463	617.7564	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.4500	11.9814		0.4600	0.0000	0.7700		6.1535 (74)	
East					9.5700	22.3313		0.4600	0.0000	0.7700		75.6963 (76)	
South					3.6100	50.9848		0.4600	0.0000	0.7700		65.1924 (78)	
West					5.2100	22.3313		0.4600	0.0000	0.7700		41.2098 (80)	
West					4.0400	22.3313		0.4300	0.0000	0.7700		29.8714 (80)	

Solar gains	218.1234	364.7703	557.8711	799.3391	932.2057	1013.6915	957.5105	854.9353	688.1742	450.9091	274.3871	180.4363	(83)
Total gains	853.6759	995.5651	1164.1320	1367.3391	1460.7324	1506.9663	1430.2261	1336.5892	1191.8778	993.1016	859.4334	798.1927	(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	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	
alpha	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	
util living area	0.9588	0.9340	0.8748	0.7537	0.5859	0.3835	0.2558	0.2817	0.5346	0.8105	0.9303	0.9655 (86)	
MIT	19.5229	19.7579	20.1742	20.6004	20.8675	20.9763	20.9956	20.9940	20.9268	20.5683	19.9715	19.4571 (87)	
Th 2	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480 (88)	
util rest of house	0.9508	0.9218	0.8522	0.7134	0.5248	0.3072	0.1700	0.1906	0.4519	0.7673	0.9149	0.9586 (89)	
MIT 2	18.0230	18.3565	18.9379	19.5037	19.8265	19.9339	19.9468	19.9462	19.8946	19.4814	18.6672	17.9294 (90)	
Living area fraction	fLA = Living area / (4) =												0.1798 (91)
MIT	18.2927	18.6085	19.1603	19.7009	20.0137	20.1214	20.1354	20.1346	20.0802	19.6769	18.9017	18.2041 (92)	
Temperature adjustment													-0.1500
adjusted MIT	18.1427	18.4585	19.0103	19.5509	19.8637	19.9714	19.9854	19.9846	19.9302	19.5269	18.7517	18.0541 (93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9320	0.8993	0.8281	0.6964	0.5196	0.3089	0.1731	0.1938	0.4504	0.7470	0.8919	0.9414	(94)
Ext temp.	795.6009	895.3106	963.9815	952.2281	759.0512	465.5127	247.5754	259.0710	536.8349	741.8954	766.5457	751.3862	(95)
Heat loss rate W	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)
Month fracti	1552.4068	1530.4768	1381.9072	1148.6997	816.9453	472.6890	248.2174	260.0261	563.0116	943.4932	1279.7238	1541.8585	(97)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	563.0636	426.8316	310.9367	141.4595	43.0732	0.0000	0.0000	0.0000	0.0000	149.9888	369.4882	588.1114 (98)
Space heating												2592.9530 (98)
Space heating per m2												(98) / (4) = 25.3813 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2865.1415 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	563.0636	426.8316	310.9367	141.4595	43.0732	0.0000	0.0000	0.0000	0.0000	149.9888	369.4882	588.1114 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	622.1697	471.6372	343.5765	156.3088	47.5947	0.0000	0.0000	0.0000	0.0000	165.7335	408.2743	649.8468 (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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665 (64)
Efficiency of water heater (217)m	89.8974	89.8237	89.6115	89.1154	88.2262	87.3000	87.3000	87.3000	87.3000	89.1215	89.7178	87.3000 (216)
Fuel for water heating, kWh/month	140.1742	122.8376	128.6639	116.7855	115.6096	103.9784	100.6258	111.3939	111.4576	122.8622	128.5292	136.2888 (219)
Water heating fuel used												1439.2066 (219)
Annual totals kWh/year												
Space heating fuel - main system												2865.1415 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.4457 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.4457 (231)
Electricity for lighting (calculated in Appendix L)												408.9946 (232)
Total delivered energy for all uses												4857.7883 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2865.1415	3.9200	112.3135 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1439.2066	3.9200	56.4169 (247)
Mechanical ventilation fans	69.4457	16.9600	11.7780 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	408.9946	16.9600	69.3655 (250)
Additional standing charges			88.0000 (251)
Total energy cost			350.5939 (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	2865.1415	0.2160	618.8706 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2066	0.2160	310.8686 (264)
Space and water heating			929.7392 (265)
Pumps and fans	144.4457	0.5190	74.9673 (267)
Energy for lighting	408.9946	0.5190	212.2682 (268)
Total kg/year			1216.9747 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2865.1415	1.2200	3495.4726 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2066	1.2200	1755.8320 (264)
Space and water heating			5251.3046 (265)
Pumps and fans	144.4457	3.0700	443.4482 (267)
Energy for lighting	408.9946	3.0700	1255.6133 (268)
Primary energy kWh/year			6950.3661 (272)
Primary energy kWh/m2/year			68.0341 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

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

(For testing purposes):		
A	Not considered	
B	Not considered	
C	Not considered	
D	Not considered	
E	Low energy lighting	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	+ 9.1	-£ 309	-947 kg (77.8%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.8	-£ 22	-143 kg (11.8%)

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
Solar photovoltaic panels	£309	9.27 kg/m²	A 95
Total Savings	£309	9.27 kg/m²	A 96
Potential energy efficiency rating:			A 95
Potential environmental impact rating:			A 96

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	£94	£94	£0
Mains gas	£257	£257	£0
Space heating	£225	£225	£0
Water heating	£56	£56	£0
Lighting	£69	£69	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£351	£42	£309
Total cost of uses	£350	£41	£309
Delivered energy	48 kWh/m²	30 kWh/m²	18 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.3 tonnes	0.9 tonnes
CO2 emissions per m²	12 kg/m²	3 kg/m²	9 kg/m²
Primary energy	68 kWh/m²	13 kWh/m²	55 kWh/m²

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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (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)			19.8400	1.1450	22.7176		(27)
French Door (Uw = 1.40)			4.0400	1.3258	5.3561		(27)
Front Door			2.1500	1.0000	2.1500		(26)
Half-Glazed Door			1.9100	1.3000	2.4830		(26a)
FP McCann System			51.0800	0.1100	5.6188	75.0000	3831.0000 (28a)
100mm Knauf Supafil 34	142.9700	27.9400	115.0300	0.2500	28.7575	52.8000	6073.5840 (29a)
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.0900	4.5972	9.0000	459.7200 (30)
Total net area of external elements Aum(A, m ²)			245.1300				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.6801		(33)
1F Timber			99.0100			9.0000	891.0900 (32c)
GF Masonry			53.8700			39.0000	2100.9300 (32c)
GF Timber			31.0500			9.0000	279.4500 (32c)
Internal Floor			51.0800			12.6000	643.6080 (32d)
Internal Ceiling			51.0800			9.0000	459.7200 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14739.1020 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							144.2747 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5521 (36)
Total fabric heat loss					(33) + (36) =		78.2322 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 41.2524	Feb 40.8435	Mar 40.7925	Apr 40.7925	May 40.7925	Jun 40.7925	Jul 40.7925	Aug 40.7925	Sep 40.7925	Oct 40.7925	Nov 40.7925	Dec 40.7925 (38)
Heat transfer coeff	119.4847	119.0757	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247 (39)
Average = Sum(39)m / 12 =												119.0673 (39)
HLP	Jan 1.1696	Feb 1.1656	Mar 1.1651	Apr 1.1651	May 1.1651	Jun 1.1651	Jul 1.1651	Aug 1.1651	Sep 1.1651	Oct 1.1651	Nov 1.1651	Dec 1.1651 (40)
HLP (average)												1.1655 (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	2.7586 (42)
Average daily hot water use (litres/day)	99.7177 (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	109.6895	105.7008	101.7121	97.7234	93.7347	89.7460	89.7460	93.7347	97.7234	101.7121	105.7008	109.6895	(44)
Energy content (annual)	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	98.2028	112.6892	114.0350	132.8969	145.0673	157.5337	(45)
Distribution loss (46)m = 0.15 x (45)m	24.4000	21.3404	22.0213	19.1987	18.4216	15.8965	14.7304	16.9034	17.1053	19.9345	21.7601	23.6301	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1470	12.7667	14.1089	13.6130	14.0328	13.5411	13.9681	14.0101	13.5803	14.0755	13.6610	14.1346	(61)
Total heat required for water heating calculated for each month	176.8133	155.0358	160.9178	141.6046	136.8438	119.5176	112.1709	126.6993	127.6153	146.9724	158.7283	171.6683	(62)
WWHRS	-50.8004	-44.6985	-45.6202	-37.5307	-34.8458	-28.7445	-24.3246	-29.4524	-30.3129	-37.4757	-43.4148	-49.1018	eq. (G10)
Total of WWHRS savings												-456.3222	
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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665	(64)
Heat gains from water heating, kWh/month	57.6233	50.4961	52.3412	45.9604	44.3429	38.6225	36.1445	40.9717	41.3117	47.7071	51.6501	55.9136	(65)
Total per year (kWh/year) = Sum(64)m =													1278.2652 (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	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8974	51.4240	41.8208	31.6610	23.6670	19.9807	21.5898	28.0633	37.6664	47.8262	55.8202	59.5066	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.7211	391.7444	381.6058	360.0218	332.7758	307.1685	290.0612	286.0378	296.1765	317.7605	345.0065	370.6138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	(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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	(71)
Water heating gains (Table 5)	77.4507	75.1431	70.3511	63.8340	59.6006	53.6423	48.5813	55.0695	57.3774	64.1224	71.7363	75.1527	(72)
Total internal gains	635.5525	630.7948	606.2610	568.0001	528.5267	493.2748	472.7156	481.6539	503.7037	542.1925	585.0463	617.7564	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North					1.4500	10.6334	0.4600	0.0000			0.7700	5.4612 (74)	
East					9.5700	19.6403	0.4600	0.0000			0.7700	66.5745 (76)	
South					3.6100	46.7521	0.4600	0.0000			0.7700	59.7801 (78)	
West					5.2100	19.6403	0.4600	0.0000			0.7700	36.2438 (80)	
West					4.0400	19.6403	0.4300	0.0000			0.7700	26.2717 (80)	
Solar gains	194.3312	360.8684	558.3238	775.9697	928.5812	943.3601	900.8975	786.8308	635.2814	417.6675	238.5569	162.3655	(83)
Total gains	829.8838	991.6632	1164.5847	1343.9698	1457.1080	1436.6349	1373.6131	1268.4847	1138.9851	959.8600	823.6032	780.1220	(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	34.2654	34.3831	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978
alpha	3.2844	3.2922	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932
util living area	0.9665	0.9414	0.8908	0.7929	0.6531	0.4972	0.3712	0.4158	0.6302	0.8537	0.9468	0.9720 (86)
MIT	19.3608	19.6475	20.0531	20.4848	20.7864	20.9348	20.9811	20.9723	20.8577	20.4246	19.7971	19.2928 (87)
Th 2	19.9444	19.9476	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480 (88)
util rest of house	0.9601	0.9309	0.8717	0.7586	0.6004	0.4256	0.2866	0.3269	0.5577	0.8202	0.9353	0.9667 (89)
MIT 2	17.7867	18.1980	18.7686	19.3530	19.7328	19.8976	19.9383	19.9327	19.8255	19.2927	18.4194	17.6914 (90)
Living area fraction									fLA = Living area / (4) =			0.1798 (91)
MIT	18.0698	18.4586	18.9995	19.5565	19.9222	20.0841	20.1258	20.1197	20.0111	19.4962	18.6671	17.9793 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9198	18.3086	18.8495	19.4065	19.7722	19.9341	19.9758	19.9697	19.8611	19.3462	18.5171	17.8293 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9432	0.9093	0.8473	0.7387	0.5909	0.4247	0.2889	0.3288	0.5512	0.7972	0.9143	0.9513	(94)
Ext temp.	782.7161	901.6836	986.7813	992.8131	861.0709	610.0740	396.8180	417.1029	627.8506	765.1844	753.0135	742.1463	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1627.3550	1596.6423	1469.9014	1250.5351	960.7961	634.8881	401.8056	424.8793	685.7180	1041.0146	1358.9182	1622.2292	(97)
	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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating kWh	628.4114	467.0122	359.4413	185.5599	74.1955	0.0000	0.0000	0.0000	0.0000	205.2176	436.2514	654.7817 (98)
Space heating												3010.8710 (98)
Space heating per m2												(98) / (4) = 29.4721 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3326.9293 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	628.4114	467.0122	359.4413	185.5599	74.1955	0.0000	0.0000	0.0000	0.0000	205.2176	436.2514	654.7817 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	694.3772	516.0356	397.1727	205.0385	81.9840	0.0000	0.0000	0.0000	0.0000	226.7598	482.0458	723.5157 (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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665 (64)
Efficiency of water heater	89.9493	89.8704	89.7015	89.3235	88.6195	87.3000	87.3000	87.3000	87.3000	89.3604	89.8117	87.3000 (216)
(217)m	89.9493	89.8704	89.7015	89.3235	88.6195	87.3000	87.3000	87.3000	87.3000	89.3604	89.8117	89.9800 (217)
Fuel for water heating, kWh/month	140.0933	122.7737	128.5348	116.5134	115.0965	103.9784	100.6258	111.3939	111.4576	122.5338	128.3947	136.2154 (219)
Water heating fuel used												1437.6113 (219)
Annual totals kWh/year												
Space heating fuel - main system												3326.9293 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.4457 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.4457 (231)
Electricity for lighting (calculated in Appendix L)												408.9946 (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												3590.7415 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3326.9293	3.4800	115.7771 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1437.6113	3.4800	50.0289 (247)
Mechanical ventilation fans	69.4457	13.1900	9.1599 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	408.9946	13.1900	53.9464 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			130.9819 (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] =	0.3738 (257)
SAP value		94.7851
SAP rating (Section 12)		95 (258)
SAP band		A

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	3326.9293	0.2160	718.6167 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1437.6113	0.2160	310.5240 (264)
Space and water heating			1029.1408 (265)
Pumps and fans	144.4457	0.5190	74.9673 (267)
Energy for lighting	408.9946	0.5190	212.2682 (268)
Energy saving/generation technologies			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			419.9390 (272)
CO2 emissions per m2			4.1100 (273)
EI value			96.1761
EI rating			96 (274)
EI band			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	51.0800 (1b)	x 2.3100 (2b)	= 117.9948 (1b) - (3b)
First floor	51.0800 (1c)	x 2.5300 (2c)	= 129.2324 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	102.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 247.2272 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																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) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			19.8400	1.1450	22.7176			(27)					
French Door (Uw = 1.40)			4.0400	1.3258	5.3561			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
Half-Glazed Door			1.9100	1.3000	2.4830			(26a)					
FP McCann System			51.0800	0.1100	5.6188	75.0000	3831.0000	(28a)					
100mm Knauf Supafil 34	142.9700	27.9400	115.0300	0.2500	28.7575	52.8000	6073.5840	(29a)					
Plane Ceiling-500mm Loft Roll	51.0800		51.0800	0.0900	4.5972	9.0000	459.7200	(30)					
Total net area of external elements Aum(A, m2)			245.1300					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		71.6801			(33)					
1F Timber			99.0100			9.0000	891.0900	(32c)					
GF Masonry			53.8700			39.0000	2100.9300	(32c)					
GF Timber			31.0500			9.0000	279.4500	(32c)					
Internal Floor			51.0800			12.6000	643.6080	(32d)					
Internal Ceiling			51.0800			9.0000	459.7200	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		14739.1020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							144.2747	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							6.5521	(36)					
Total fabric heat loss						(33) + (36) =	78.2322	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 40.7925	Feb 40.7925	Mar 40.7925	Apr 40.7925	May 40.7925	Jun 40.7925	Jul 40.7925	Aug 40.7925	Sep 40.7925	Oct 40.7925	Nov 40.7925	Dec 40.7925	(38)
Heat transfer coeff	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	119.0247	(39)
Average = Sum(39)m / 12 =												119.0247	(39)
HLP	Jan 1.1651	Feb 1.1651	Mar 1.1651	Apr 1.1651	May 1.1651	Jun 1.1651	Jul 1.1651	Aug 1.1651	Sep 1.1651	Oct 1.1651	Nov 1.1651	Dec 1.1651	(40)
HLP (average)												1.1651	(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	2.7586 (42)
Average daily hot water use (litres/day)	99.7177 (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	109.6895	105.7008	101.7121	97.7234	93.7347	89.7460	89.7460	93.7347	97.7234	101.7121	105.7008	109.6895	(44)
Energy conte	162.6664	142.2691	146.8089	127.9916	122.8110	105.9765	98.2028	112.6892	114.0350	132.8969	145.0673	157.5337	(45)
Energy content (annual)	Total = Sum (45)m = 1568.9484												(45)
Distribution loss (46)m = 0.15 x (45)m	24.4000	21.3404	22.0213	19.1987	18.4216	15.8965	14.7304	16.9034	17.1053	19.9345	21.7601	23.6301	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1470	12.7667	14.1089	13.6130	14.0328	13.5411	13.9681	14.0101	13.5803	14.0755	13.6610	14.1346	(61)
Total heat required for water heating calculated for each month	176.8133	155.0358	160.9178	141.6046	136.8438	119.5176	112.1709	126.6993	127.6153	146.9724	158.7283	171.6683	(62)
WWHRS	-50.8004	-44.6985	-45.6202	-37.5307	-34.8458	-28.7445	-24.3246	-29.4524	-30.3129	-37.4757	-43.4148	-49.1018	eq. (G10)
Total of WWHRS savings	-456.3222												
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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665	(64)
Heat gains from water heating, kWh/month	57.6233	50.4961	52.3412	45.9604	44.3429	38.6225	36.1445	40.9717	41.3117	47.7071	51.6501	55.9136	(65)
Total per year (kWh/year) = Sum (64)m =	1278.2652												(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	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	165.5185	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.8974	51.4240	41.8208	31.6610	23.6670	19.9807	21.5898	28.0633	37.6664	47.8262	55.8202	59.5066	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	387.7211	391.7444	381.6058	360.0218	332.7758	307.1685	290.0612	286.0378	296.1765	317.7605	345.0065	370.6138	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	54.3105	(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)	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	-110.3457	(71)
Water heating gains (Table 5)	77.4507	75.1431	70.3511	63.8340	59.6006	53.6423	48.5813	55.0695	57.3774	64.1224	71.7363	75.1527	(72)
Total internal gains	635.5525	630.7948	606.2610	568.0001	528.5267	493.2748	472.7156	481.6539	503.7037	542.1925	585.0463	617.7564	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W
North					1.4500	11.9814	0.4600	0.0000			0.7700			6.1535 (74)
East					9.5700	22.3313	0.4600	0.0000			0.7700			75.6963 (76)
South					3.6100	50.9848	0.4600	0.0000			0.7700			65.1924 (78)
West					5.2100	22.3313	0.4600	0.0000			0.7700			41.2098 (80)
West					4.0400	22.3313	0.4300	0.0000			0.7700			29.8714 (80)
Solar gains	218.1234	364.7703	557.8711	799.3391	932.2057	1013.6915	957.5105	854.9353	688.1742	450.9091	274.3871	180.4363	(83)	
Total gains	853.6759	995.5651	1164.1320	1367.3391	1460.7324	1506.9663	1430.2261	1336.5892	1191.8778	993.1016	859.4334	798.1927	(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	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	34.3978	
alpha	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	3.2932	
util living area	0.9588	0.9340	0.8748	0.7537	0.5859	0.3835	0.2558	0.2817	0.5346	0.8105	0.9303	0.9655	(86)
MIT	19.5229	19.7579	20.1742	20.6004	20.8675	20.9763	20.9956	20.9940	20.9268	20.5683	19.9715	19.4571	(87)
Th 2	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	19.9480	(88)
util rest of house	0.9508	0.9218	0.8522	0.7134	0.5248	0.3072	0.1700	0.1906	0.4519	0.7673	0.9149	0.9586	(89)
MIT 2	18.0230	18.3565	18.9379	19.5037	19.8265	19.9339	19.9468	19.9462	19.8946	19.4814	18.6672	17.9294	(90)
Living area fraction	fLA = Living area / (4) =												0.1798 (91)
MIT	18.2927	18.6085	19.1603	19.7009	20.0137	20.1214	20.1354	20.1346	20.0802	19.6769	18.9017	18.2041	(92)
Temperature adjustment	-0.1500												
adjusted MIT	18.1427	18.4585	19.0103	19.5509	19.8637	19.9714	19.9854	19.9846	19.9302	19.5269	18.7517	18.0541	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	795.6009	895.3106	963.9815	952.2281	759.0512	465.5127	247.5754	259.0710	536.8349	741.8954	766.5457	751.3862	(94)
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	1552.4068	1530.4768	1381.9072	1148.6997	816.9453	472.6890	248.2174	260.0261	563.0116	943.4932	1279.7238	1541.8585	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating kWh	563.0636	426.8316	310.9367	141.4595	43.0732	0.0000	0.0000	0.0000	0.0000	149.9888	369.4882	588.1114 (98)
Space heating												2592.9530 (98)
Space heating per m2												(98) / (4) = 25.3813 (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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2865.1415 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	563.0636	426.8316	310.9367	141.4595	43.0732	0.0000	0.0000	0.0000	0.0000	149.9888	369.4882	588.1114 (98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000 (210)
Space heating fuel (main heating system)	622.1697	471.6372	343.5765	156.3088	47.5947	0.0000	0.0000	0.0000	0.0000	165.7335	408.2743	649.8468 (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	126.0130	110.3373	115.2976	104.0739	101.9980	90.7731	87.8463	97.2469	97.3024	109.4966	115.3135	122.5665 (64)
Efficiency of water heater	89.8974	89.8237	89.6115	89.1154	88.2262	87.3000	87.3000	87.3000	87.3000	89.1215	89.7178	87.3000 (216)
(217)m	89.8974	89.8237	89.6115	89.1154	88.2262	87.3000	87.3000	87.3000	87.3000	89.1215	89.7178	89.9315 (217)
Fuel for water heating, kWh/month	140.1742	122.8376	128.6639	116.7855	115.6096	103.9784	100.6258	111.3939	111.4576	122.8622	128.5292	136.2888 (219)
Water heating fuel used												1439.2066 (219)
Annual totals kWh/year												
Space heating fuel - main system												2865.1415 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 10.3610, total flow = 45.0000, SFP = 0.2302)												
mechanical ventilation fans (SFP = 0.2302)												69.4457 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												144.4457 (231)
Electricity for lighting (calculated in Appendix L)												408.9946 (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												3033.6286 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2865.1415	3.9200	112.3135 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1439.2066	3.9200	56.4169 (247)
Mechanical ventilation fans	69.4457	16.9600	11.7780 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	408.9946	16.9600	69.3655 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			41.2164 (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	2865.1415	0.2160	618.8706 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2066	0.2160	310.8686 (264)
Space and water heating			929.7392 (265)
Pumps and fans	144.4457	0.5190	74.9673 (267)
Energy for lighting	408.9946	0.5190	212.2682 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			270.2358 (272)

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	2865.1415	1.2200	3495.4726 (261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1439.2066	1.2200	1755.8320 (264)
Space and water heating			5251.3046 (265)
Pumps and fans	144.4457	3.0700	443.4482 (267)
Energy for lighting	408.9946	3.0700	1255.6133 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1350.1961 (272)
Primary energy kWh/m2/year			13.2165 (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	East
Overshading	Average or unknown
Thermal mass parameter	144.3 (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	326.34 (P1)
Transmission heat loss coefficient	78.23 (37)
Summer heat loss coefficient	404.57 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.4500	81.1852	0.4600	0.0000	0.9000	48.7355
East	9.5700	117.5071	0.4600	0.0000	0.9000	465.5607
South	3.6100	112.2060	0.4600	0.0000	0.9000	167.6964
West	5.2100	117.5071	0.4600	0.0000	0.9000	253.4557
West	4.0400	117.5071	0.4300	0.0000	0.9000	183.7200

total: 1119.1681

	Jun	Jul	Aug	
Solar gains	1185	1119	999	(P4)
Internal gains	490	479	479	
Total summer gains	1675	1589	1478	(P5)
Summer gain/loss ratio	4.14	3.93	3.65	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 144.3)	0.99	0.99	0.99	
Threshold temperature	21.13	22.82	22.44	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			