

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Flanders Detached			Issued on Date	15/12/2022
Assessment Reference	Flanders Detached	Prop Type Ref	Flanders		
Property	2 Bed, B, Bungalow				
SAP Rating	85 B	DER	15.55	TER	20.68
Environmental	88 B	% DER<TER	24.81		
CO ₂ Emissions (t/year)	0.98	DFEE	45.11	TFEE	60.88
General Requirements Compliance	Pass	% DFEE<TFEE	25.91		
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 Bungalow, total floor area 75 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) 20.68 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.55 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)60.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	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 ESPl 30
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 South East: 6.02 m², No overhang
Windows facing North West: 3.42 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Roof U-value 0.09 W/m²K
Floor U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Window U-value 0.90 W/m²K
Thermal bridging y-value 0.020 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	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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)

	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	0.2556	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												0.5000 (23a)
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
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			6.1100	1.1450	6.9962		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			75.4800	0.1100	8.3028	75.0000	5661.0000 (28a)
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.2500	18.0600	52.8000	3814.2720 (29a)
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.0900	6.7932	9.0000	679.3200 (30)
Total net area of external elements Aum(A, m ²)			234.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.7170			(33)
Timber GF			142.3300			9.0000	1280.9700 (32c)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	11435.5620 (34)			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K				151.5045 (35)			(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				4.6466 (36)			(36)
Total fabric heat loss			(33) + (36) =	51.3636 (37)			(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	29.8493	29.5533	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165 (38)
Heat transfer coeff	81.2128	80.9169	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800 (39)
Average = Sum(39)m / 12 =	80.9108 (39)											(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0760	1.0720	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715 (40)
HLP (average)	1.0720 (40)											(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	2.3715 (42)											(42)
Average daily hot water use (litres/day)	90.5234 (43)											(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.5757	95.9548	92.3339	88.7129	85.0920	81.4711	81.4711	85.0920	88.7129	92.3339	95.9548	99.5757 (44)
Energy conte	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Energy content (annual)	Total = Sum(45)m = 1424.2854 (45)											(45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	22.1502	19.3727	19.9909	17.4285	16.7231	14.4308	13.3722	15.3448	15.5281	18.0965	19.7537	21.4513 (46)
Total storage loss												
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 (56)
Combi loss	14.6580	13.2129	14.5861	14.0675	14.5015	13.9934	14.4348	14.4781	14.0338	14.5511	14.1374	14.6441 (61)
Total heat required for water heating calculated for each month												
WWHRS	162.3260	142.3642	147.8587	130.2578	125.9888	110.1985	103.5830	116.7769	117.5544	135.1944	145.8290	157.6526 (62)
Total of WWHRS savings	-47.9771	-42.2113	-43.0834	-35.4643	-32.9378	-27.1781	-23.0127	-27.8593	-28.6671	-35.4264	-41.0205	-46.3684 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-431.2065
Output from w/h								Solar input	(sum of months) =	Sum (63)m =		0.0000 (63)
	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842 (64)
								Total per year (kWh/year) =	Sum (64)m =			1164.3776 (64)
Heat gains from water heating, kWh/month												
	52.7641	46.2460	47.9597	42.1501	40.6949	35.4866	33.2505	37.6339	37.9290	43.7517	47.3218	51.2114 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9775	0.9641	0.9382	0.8837	0.7822	0.6224	0.4560	0.5024	0.7329	0.9046	0.9643	0.9811 (94)
Useful gains	441.9277	498.6141	538.2620	553.9493	516.2137	401.4322	280.5671	291.0962	395.6202	439.2968	425.7877	419.8164 (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	1127.9722	1096.9625	1000.4778	847.6722	657.8144	445.5704	291.1277	306.2735	477.3023	713.9322	938.7906	1126.4564 (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	510.4172	402.0901	343.8885	211.4808	105.3509	0.0000	0.0000	0.0000	0.0000	204.3287	369.3621	525.7401 (98)
Space heating												2672.6585 (99)
Space heating per m2												35.4088 (99)
										(98) / (4) =		

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)											
Fraction of space heat from main system(s)	1.0000 (202)											
Efficiency of main space heating system 1 (in %)	90.5000 (206)											
Efficiency of secondary/supplementary heating system, %	0.0000 (208)											
Space heating requirement	2953.2138 (211)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	510.4172	402.0901	343.8885	211.4808	105.3509	0.0000	0.0000	0.0000	0.0000	204.3287	369.3621	525.7401 (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)	563.9969	444.2985	379.9873	233.6804	116.4099	0.0000	0.0000	0.0000	0.0000	225.7776	408.1349	580.9283 (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	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842 (64)
Efficiency of water heater (217)m	89.8969	89.8433	89.7319	89.4848	88.9705	87.3000	87.3000	87.3000	87.3000	89.4246	89.7727	87.3000 (216)
Fuel for water heating, kWh/month	127.2000	111.4751	116.7648	105.9326	104.5864	95.0978	92.2913	101.8529	101.8182	111.5665	116.7487	123.7534 (219)
Water heating fuel used												1309.0876 (219)
Annual totals kWh/year												
Space heating fuel - main system												2953.2138 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)												
mechanical ventilation fans (SFP = 0.2260)												49.3125 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												124.3125 (231)
Electricity for lighting (calculated in Appendix L)												363.1807 (232)
Total delivered energy for all uses												4749.7946 (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	2953.2138	0.2160	637.8942 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1309.0876	0.2160	282.7629 (264)
Space and water heating			920.6571 (265)
Pumps and fans	124.3125	0.5190	64.5182 (267)
Energy for lighting	363.1807	0.5190	188.4908 (268)
Total CO2, kg/year			1173.6661 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.5500 (273)

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

DER		15.5500 ZC1
Total Floor Area	TFA	75.4800
Assumed number of occupants	N	2.3715
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		16.4659 ZC2
CO2 emissions from cooking, equation (L16)		2.3306 ZC3
Total CO2 emissions		34.3466 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.3466 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	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1677 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4177 (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) =				0.4177 (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	0.5326	0.5221	0.5117	0.4595	0.4490	0.3968	0.3968	0.3864	0.4177	0.4490	0.4699	0.4908 (22b)
Effective ac	0.6418	0.6363	0.6309	0.6056	0.6008	0.5787	0.5787	0.5746	0.5872	0.6008	0.6104	0.6204 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			9.4400	1.3258	12.5152		(27)
FP McCann System			75.4800	0.1300	9.8124		(28a)
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.1800	13.0032		(29a)
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.1300	9.8124		(30)
Total net area of external elements Aum, m ²			234.7900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.2932	(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)							10.1641 (36)
Total fabric heat loss						(33) + (36) =	57.4573 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.8883	37.5632	37.2445	35.7478	35.4678	34.1642	34.1642	33.9228	34.6664	35.4678	36.0343	36.6265 (38)
Heat transfer coeff	95.3455	95.0204	94.7018	93.2051	92.9251	91.6215	91.6215	91.3801	92.1236	92.9251	93.4916	94.0838 (39)
Average = Sum(39)m / 12 =												93.2038 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2632	1.2589	1.2547	1.2348	1.2311	1.2139	1.2139	1.2107	1.2205	1.2311	1.2386	1.2465 (40)
HLP (average)												1.2348 (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												2.3715 (42)
Average daily hot water use (litres/day)												90.5234 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.5757	95.9548	92.3339	88.7129	85.0920	81.4711	81.4711	85.0920	88.7129	92.3339	95.9548	99.5757 (44)
Energy conte	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Energy content (annual)										Total = Sum(45)m =		1424.2854 (45)
Distribution loss (46)m = 0.15 x (45)m	22.1502	19.3727	19.9909	17.4285	16.7231	14.4308	13.3722	15.3448	15.5281	18.0965	19.7537	21.4513 (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)

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Combi loss	50.7427	44.1655	47.0523	43.7488	43.3619	40.1775	41.5168	43.3619	43.7488	47.0523	47.3202	50.7427 (61)
Total heat required for water heating calculated for each month	198.4106	173.3168	180.3249	159.9391	154.8493	136.3826	130.6649	145.6608	147.2694	167.6956	179.0117	193.7512 (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	198.4106	173.3168	180.3249	159.9391	154.8493	136.3826	130.6649	145.6608	147.2694	167.6956	179.0117	193.7512 (64)
Heat gains from water heating, kWh/month	61.7853	53.9842	56.0762	49.5705	47.9100	42.0326	40.0210	44.8548	45.3578	51.8770	55.6175	60.2360 (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	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.5648	18.2655	14.8545	11.2458	8.4064	7.0970	7.6686	9.9679	13.3789	16.9876	19.8270	21.1364 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.7357	211.9121	206.4276	194.7519	180.0133	166.1611	156.9070	154.7306	160.2151	171.8909	186.6294	200.4816 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576 (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)	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604 (71)
Water heating gains (Table 5)	83.0447	80.3336	75.3713	68.8479	64.3952	58.3786	53.7916	60.2888	62.9970	69.7271	77.2465	80.9624 (72)
Total internal gains	374.9178	372.0838	358.2260	336.4182	314.3875	293.2094	279.9399	286.5600	298.1636	320.1782	345.2756	364.1530 (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
Southeast					6.0200	36.7938	0.6300	0.7000				0.7700	67.6929 (77)
Northwest					3.4200	11.2829	0.6300	0.7000				0.7700	11.7929 (81)
Solar gains	79.4858	139.3109	201.0158	266.5080	314.4293	319.1573	304.7879	267.9660	223.5277	156.7735	95.9190	67.5617	(83)
Total gains	454.4037	511.3947	559.2418	602.9262	628.8168	612.3667	584.7278	554.5260	521.6913	476.9518	441.1946	431.7147	(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	54.9755	55.1636	55.3492	56.2380	56.4075	57.2100	57.2100	57.3611	56.8982	56.4075	56.0657	55.7127
alpha	4.6650	4.6776	4.6899	4.7492	4.7605	4.8140	4.8140	4.8241	4.7932	4.7605	4.7377	4.7142
util living area	0.9979	0.9960	0.9912	0.9756	0.9286	0.8096	0.6491	0.6978	0.8980	0.9821	0.9960	0.9984 (86)
MIT	19.6117	19.7550	20.0002	20.3388	20.6563	20.8885	20.9710	20.9589	20.7946	20.3894	19.9468	19.5943 (87)
Th 2	19.8698	19.8732	19.8765	19.8922	19.8952	19.9089	19.9089	19.9115	19.9036	19.8952	19.8892	19.8830 (88)
util rest of house	0.9972	0.9946	0.9878	0.9652	0.8952	0.7212	0.5077	0.5605	0.8374	0.9726	0.9944	0.9978 (89)
MIT 2	18.0282	18.2397	18.5990	19.0979	19.5385	19.8283	19.8976	19.8933	19.7277	19.1771	18.5316	18.0120 (90)
Living area fraction									fLA = Living area / (4) =			0.3642 (91)
MIT	18.6049	18.7916	19.1093	19.5499	19.9456	20.2145	20.2885	20.2814	20.1163	19.6186	19.0471	18.5883 (92)
Temperature adjustment												0.0000
adjusted MIT	18.6049	18.7916	19.1093	19.5499	19.9456	20.2145	20.2885	20.2814	20.1163	19.6186	19.0471	18.5883 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9960	0.9927	0.9846	0.9610	0.8970	0.7489	0.5598	0.6108	0.8514	0.9694	0.9925	0.9969 (94)
Useful gains	452.6027	507.6654	550.6522	579.4104	564.0629	458.5932	327.3214	338.6973	444.1831	462.3400	437.9039	430.3680 (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	1363.9084	1319.9844	1194.1273	992.6207	766.2232	514.4045	337.9447	354.6846	554.2387	838.0545	1116.9493	1353.7030 (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	678.0114	545.8784	478.7454	297.5114	150.4072	0.0000	0.0000	0.0000	0.0000	279.5315	488.9127	686.9613 (98)
Space heating												3605.9593 (98)
Space heating per m2										(98) / (4) =		47.7737 (99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.4000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3860.7701	(211)
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec		
Space heating requirement	678.0114 545.8784 478.7454 297.5114 150.4072 0.0000 0.0000 0.0000 0.0000 279.5315 488.9127 686.9613	(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)	725.9223 584.4523 512.5754 318.5347 161.0356 0.0000 0.0000 0.0000 0.0000 299.2843 523.4611 735.5046	(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	198.4106 173.3168 180.3249 159.9391 154.8493 136.3826 130.6649 145.6608 147.2694 167.6956 179.0117 193.7512	(64)
Efficiency of water heater	87.8972 87.7405 87.3925 86.5920 84.9780 80.3000 80.3000 80.3000 80.3000 86.3285 87.4520 87.9659	(216)
Fuel for water heating, kWh/month	225.7304 197.5334 206.3391 184.7042 182.2227 169.8413 162.7209 181.3957 183.3990 194.2529 204.6972 220.2571	(219)
Water heating fuel used		2313.0940 (219)
Annual totals kWh/year		
Space heating fuel - main system		3860.7701 (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)		363.1807 (232)
Total delivered energy for all uses		6612.0448 (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	3860.7701	0.2160	833.9264 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2313.0940	0.2160	499.6283 (264)
Space and water heating			1333.5546 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	363.1807	0.5190	188.4908 (268)
Total CO2, kg/m2/year			1560.9704 (272)
Emissions per m2 for space and water heating			17.6677 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4972 (272b)
Emissions per m2 for pumps and fans			0.5157 (272c)
Target Carbon Dioxide Emission Rate (TER) = (17.6677 * 1.00) + 2.4972 + 0.5157, rounded to 2 d.p.			20.6800 (273)

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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	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1677 (8)
Measured/design AP50					Yes
Infiltration rate					4.0100
Number of sides sheltered					0.3682 (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) =				0.3682 (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	0.4695	0.4603	0.4510	0.4050	0.3958	0.3498	0.3498	0.3406	0.3682	0.3958	0.4142	0.4326 (22b)
	0.6102	0.6059	0.6017	0.5820	0.5783	0.5612	0.5612	0.5580	0.5678	0.5783	0.5858	0.5936 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			6.1100	1.1450	6.9962		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			75.4800	0.1100	8.3028	75.0000	5661.0000 (28a)
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.2500	18.0600	52.8000	3814.2720 (29a)
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.0900	6.7932	9.0000	679.3200 (30)
Total net area of external elements Aum(A, m ²)			234.7900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.7170		(33)
Timber GF			142.3300			9.0000	1280.9700 (32c)
Heat capacity Cm = Sum (A x k)				(28)...(30) + (32) + (32a)...(32e) =			11435.5620 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.5045 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6466 (36)
Total fabric heat loss						(33) + (36) =	51.3636 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	36.0216	35.7690	35.5214	34.3584	34.1409	33.1279	33.1279	32.9404	33.5181	34.1409	34.5810	35.0412 (38)
Average = Sum(39)m / 12 =	87.3852	87.1326	86.8850	85.7220	85.5044	84.4915	84.4915	84.3040	84.8817	85.5044	85.9446	86.4048 (39)
												85.7210 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1577	1.1544	1.1511	1.1357	1.1328	1.1194	1.1194	1.1169	1.1246	1.1328	1.1386	1.1447 (40)
Days in month												1.1357 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3715 (42)
Average daily hot water use (litres/day)												90.5234 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	99.5757	95.9548	92.3339	88.7129	85.0920	81.4711	81.4711	85.0920	88.7129	92.3339	95.9548	99.5757 (44)
Energy content (annual)	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1424.2854 (45)
	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												

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.3794	27.4447	28.3204	24.6904	23.6911	20.4436	18.9440	21.7385	21.9981	25.6367	27.9845	30.3893 (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	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.5648	18.2655	14.8545	11.2458	8.4064	7.0970	7.6686	9.9679	13.3789	16.9876	19.8270	21.1364 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.7357	211.9121	206.4276	194.7519	180.0133	166.1611	156.9070	154.7306	160.2151	171.8909	186.6294	200.4816 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576 (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)	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604 (71)
Water heating gains (Table 5)	42.1767	40.8403	38.0651	34.2923	31.8428	28.3939	25.4623	29.2184	30.5530	34.4579	38.8673	40.8458 (72)
Total internal gains	331.0498	329.5905	317.9198	298.8626	278.8352	260.2247	248.6106	252.4896	262.7196	281.9090	303.8964	321.0364 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Southeast	2.6900	36.7938	0.4600	0.0000	0.7700	35.0571 (77)
Northwest	3.4200	11.2829	0.4600	0.0000	0.7700	13.6677 (81)
Southeast	3.3300	36.7938	0.4300	0.0000	0.7700	40.5675 (77)

Solar gains	89.2924	156.6378	226.3774	300.7048	355.2632	360.8092	344.4815	302.5378	251.9221	176.3695	107.7784	75.8807 (83)
Total gains	420.3422	486.2283	544.2972	599.5674	634.0984	621.0339	593.0921	555.0274	514.6417	458.2785	411.6748	396.9171 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	36.3511	36.4564	36.5603	37.0563	37.1506	37.5960	37.5960	37.6797	37.4232	37.1506	36.9604	36.7635
alpha	3.4234	3.4304	3.4374	3.4704	3.4767	3.5064	3.5064	3.5120	3.4949	3.4767	3.4640	3.4509
util living area	0.9899	0.9826	0.9675	0.9311	0.8552	0.7215	0.5750	0.6241	0.8249	0.9490	0.9835	0.9917 (86)
MIT	19.1186	19.3303	19.6754	20.1311	20.5409	20.8311	20.9440	20.9246	20.7068	20.1752	19.5686	19.0855 (87)
Th 2	19.9540	19.9567	19.9593	19.9718	19.9741	19.9850	19.9850	19.9871	19.9808	19.9741	19.9694	19.9645 (88)
util rest of house	0.9877	0.9788	0.9601	0.9142	0.8171	0.6454	0.4621	0.5134	0.7655	0.9332	0.9793	0.9899 (89)
MIT 2	18.2358	18.4477	18.7908	19.2444	19.6304	19.8863	19.9633	19.9553	19.7894	19.2955	18.6954	18.2106 (90)
Living area fraction									fLA = Living area / (4) =			0.3642 (91)
MIT	18.5573	18.7691	19.1129	19.5674	19.9620	20.2304	20.3205	20.3083	20.1235	19.6159	19.0134	18.5292 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5573	18.7691	19.1129	19.5674	19.9620	20.2304	20.3205	20.3083	20.1235	19.6159	19.0134	18.5292 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	413.5342	473.2060	518.4214	543.3326	517.7860	413.1963	297.4326	305.7836	398.8346	424.5178	401.0090	391.5636 (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	1245.8807	1208.4549	1095.8754	914.4289	706.4378	475.7202	314.3502	329.4837	511.2868	770.8971	1023.8911	1238.1133 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	619.2658	494.0872	429.6258	267.1893	140.3569	0.0000	0.0000	0.0000	0.0000	257.7062	448.4752	629.8330 (98)
Space heating												3286.5393 (98)
Space heating per m2										(98) / (4) =		43.5419 (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	794.2204	625.2373	640.7100	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7880	0.8554	0.8297	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	625.8310	534.8103	531.6087	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	814.8939	780.4948	737.7258	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												

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Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	136.1253	182.7893	153.3511	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												472.2657 (104)
Intermittency factor (Table 10b)									FC = cooled area / (4) =			1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	34.0313	45.6973	38.3378	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												118.0664 (107)
Energy for space heating												1.5642 (108)
Energy for space cooling												43.5419 (99)
Total												1.5642 (108)
Dwelling Fabric Energy Efficiency (DFEE)												45.1061 (109)
												45.1 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				Air changes per hour
Pressure test					30.0000 / (5) = 0.1677 (8)
Measured/design AP50					Yes
Infiltration rate					5.0000
Number of sides sheltered					0.4177 (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) =				0.4177 (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	0.5326	0.5221	0.5117	0.4595	0.4490	0.3968	0.3968	0.3864	0.4177	0.4490	0.4699	0.4908 (22b)
Effective ac	0.6418	0.6363	0.6309	0.6056	0.6008	0.5787	0.5787	0.5746	0.5872	0.6008	0.6104	0.6204 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Opening Type (Uw = 1.40)			9.4400	1.3258	12.5152		(27)
FP McCann System			75.4800	0.1300	9.8124		(28a)
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.1800	13.0032		(29a)
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.1300	9.8124		(30)
Total net area of external elements Aum, m ²			234.7900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	47.2932	(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)							10.1641 (36)
Total fabric heat loss						(33) + (36) =	57.4573 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.8883	37.5632	37.2445	35.7478	35.4678	34.1642	34.1642	33.9228	34.6664	35.4678	36.0343	36.6265 (38)
Heat transfer coeff	95.3455	95.0204	94.7018	93.2051	92.9251	91.6215	91.6215	91.3801	92.1236	92.9251	93.4916	94.0838 (39)
Average = Sum(39)m / 12 =												93.2038 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2632	1.2589	1.2547	1.2348	1.2311	1.2139	1.2139	1.2107	1.2205	1.2311	1.2386	1.2465 (40)
HLP (average)												1.2348 (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												2.3715 (42)
Average daily hot water use (litres/day)												90.5234 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.5757	95.9548	92.3339	88.7129	85.0920	81.4711	81.4711	85.0920	88.7129	92.3339	95.9548	99.5757 (44)
Energy conte	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Energy content (annual)										Total = Sum(45)m =		1424.2854 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.3794	27.4447	28.3204	24.6904	23.6911	20.4436	18.9440	21.7385	21.9981	25.6367	27.9845	30.3893 (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	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	118.5756	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.5648	18.2655	14.8545	11.2458	8.4064	7.0970	7.6686	9.9679	13.3789	16.9876	19.8270	21.1364	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	209.7357	211.9121	206.4276	194.7519	180.0133	166.1611	156.9070	154.7306	160.2151	171.8909	186.6294	200.4816	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	34.8576	(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)	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	(71)
Water heating gains (Table 5)	42.1767	40.8403	38.0651	34.2923	31.8428	28.3939	25.4623	29.2184	30.5530	34.4579	38.8673	40.8458	(72)
Total internal gains	331.0498	329.5905	317.9198	298.8626	278.8352	260.2247	248.6106	252.4896	262.7196	281.9090	303.8964	321.0364	(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
Southeast					6.0200	36.7938		0.6300	0.7000	0.7700		67.6929 (77)
Northwest					3.4200	11.2829		0.6300	0.7000	0.7700		11.7929 (81)
Solar gains	79.4858	139.3109	201.0158	266.5080	314.4293	319.1573	304.7879	267.9660	223.5277	156.7735	95.9190	67.5617 (83)
Total gains	410.5356	468.9013	518.9357	565.3706	593.2644	579.3820	553.3985	520.4556	486.2473	438.6826	399.8154	388.5982 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9755	55.1636	55.3492	56.2380	56.4075	57.2100	57.2100	57.3611	56.8982	56.4075	56.0657	55.7127	
alpha	4.6650	4.6776	4.6899	4.7492	4.7605	4.8140	4.8140	4.8241	4.7932	4.7605	4.7377	4.7142	
util living area	0.9987	0.9972	0.9935	0.9809	0.9409	0.8329	0.6773	0.7298	0.9174	0.9871	0.9974	0.9990	(86)
MIT	19.5587	19.7040	19.9529	20.2976	20.6248	20.8723	20.9652	20.9501	20.7671	20.3460	19.8970	19.5420	(87)
Th 2	19.8698	19.8732	19.8765	19.8922	19.8952	19.9089	19.9089	19.9115	19.9036	19.8952	19.8892	19.8830	(88)
util rest of house	0.9982	0.9963	0.9910	0.9725	0.9117	0.7486	0.5337	0.5921	0.8642	0.9800	0.9963	0.9986	(89)
MIT 2	18.5596	18.7073	18.9577	19.3105	19.6247	19.8441	19.8993	19.8959	19.7630	19.3633	18.9129	18.5533	(90)
Living area fraction									fLA = Living area / (4) =			0.3642	(91)
MIT	18.9234	19.0703	19.3201	19.6700	19.9889	20.2186	20.2875	20.2798	20.1287	19.7212	19.2713	18.9134	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9234	19.0703	19.3201	19.6700	19.9889	20.2186	20.2875	20.2798	20.1287	19.7212	19.2713	18.9134	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9976	0.9953	0.9893	0.9703	0.9147	0.7757	0.5871	0.6430	0.8774	0.9785	0.9954	0.9982	(94)
Useful gains	409.5692	466.6964	513.3744	548.5894	542.6867	449.4246	324.8866	334.6778	426.6541	429.2677	397.9838	387.8971	(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	1394.2804	1346.4688	1214.0901	1003.8226	770.2487	514.7855	337.8564	354.5391	555.3884	847.5857	1137.9146	1384.2908	(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	732.6251	591.2070	521.3325	327.7679	169.3061	0.0000	0.0000	0.0000	0.0000	311.2286	532.7502	741.3169	(98)
Space heating												3927.5343	(98)
Space heating per m2										(98) / (4) =		52.0341	(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	861.2421	677.9991	694.4887	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7763	0.8592	0.8300	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	668.5832	582.5206	576.4103	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	766.2099	734.0998	697.3172	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	70.2913	112.7749	89.9548	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												273.0209	(104)
Cooled fraction												1.0000	(105)
Intermittency factor (Table 10b)													
													fC = cooled area / (4) =

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	17.5728	28.1937	22.4887	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												68.2552 (107)
Energy for space heating												0.9043 (108)
Energy for space cooling												52.0341 (99)
Total												0.9043 (108)
Target Fabric Energy Efficiency (TFEE)												52.9384 (109)
												60.9 (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	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (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)			
Air changes per hour												
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)
Mechanical extract ventilation - decentralised	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)
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
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			6.1100	1.1450	6.9962		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			75.4800	0.1100	8.3028	75.0000	5661.0000 (28a)
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.2500	18.0600	52.8000	3814.2720 (29a)
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.0900	6.7932	9.0000	679.3200 (30)
Total net area of external elements Aum(A, m ²)			234.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.7170		(33)
Timber GF			142.3300			9.0000	1280.9700 (32c)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	11435.5620 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.5045 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6466 (36)
Total fabric heat loss						(33) + (36) =	51.3636 (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	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165 (38)
Heat transfer coeff	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800 (39)
Average = Sum(39)m / 12 =												80.8800 (39)
HLP	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715 (40)
HLP (average)												1.0715 (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												2.3715 (42)
Average daily hot water use (litres/day)												90.5234 (43)
Daily hot water use	Jan 99.5757	Feb 95.9548	Mar 92.3339	Apr 88.7129	May 85.0920	Jun 81.4711	Jul 81.4711	Aug 85.0920	Sep 88.7129	Oct 92.3339	Nov 95.9548	Dec 99.5757 (44)
Energy conte	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Energy content (annual)												Total = Sum(45)m = 1424.2854 (45)
Distribution loss (46)m = 0.15 x (45)m												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	22.1502	19.3727	19.9909	17.4285	16.7231	14.4308	13.3722	15.3448	15.5281	18.0965	19.7537	21.4513 (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	14.6580	13.2129	14.5861	14.0675	14.5015	13.9934	14.4348	14.4781	14.0338	14.5511	14.1374	14.6441 (61)
Total heat required for water heating calculated for each month	162.3260	142.3642	147.8587	130.2578	125.9888	110.1985	103.5830	116.7769	117.5544	135.1944	145.8290	157.6526 (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	162.3260	142.3642	147.8587	130.2578	125.9888	110.1985	103.5830	116.7769	117.5544	135.1944	145.8290	157.6526 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	52.7641	46.2460	47.9597	42.1501	40.6949	35.4866	33.2505	37.6339	37.9290	43.7517	47.3218	51.2114 (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	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.4120	45.6637	37.1362	28.1145	21.0159	17.7425	19.1714	24.9197	33.4472	42.4689	49.5675	52.8409 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	313.0383	316.2867	308.1009	290.6744	268.6766	248.0017	234.1896	230.9413	239.1270	256.5535	278.5514	299.2262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006 (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)	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604 (71)
Water heating gains (Table 5)	70.9195	68.8185	64.4619	58.5419	54.6975	49.2869	44.6915	50.5832	52.6792	58.8060	65.7247	68.8325 (72)
Total internal gains	537.4006	532.7996	511.7298	479.3616	446.4207	417.0619	400.0833	408.4750	427.2843	459.8592	495.8744	522.9304 (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	
Southeast				2.6900	40.4699	0.4600	0.0000		0.7700		38.5597 (77)	
Northwest				3.4200	12.9236	0.4600	0.0000		0.7700		15.6551 (81)	
Southeast				3.3300	40.4699	0.4300	0.0000		0.7700		44.6206 (77)	
Solar gains	98.8354	156.2861	224.0382	308.4411	356.4639	388.0109	366.2213	327.8982	270.8531	188.1350	122.2666	83.1525 (83)
Total gains	636.2360	689.0858	735.7680	787.8027	802.8847	805.0728	766.3046	736.3731	698.1374	647.9943	618.1410	606.0829 (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	39.2748	39.2748	39.2748	39.2748	39.2748	39.2748	39.2748	39.2748	39.2748	39.2748	39.2748	39.2748
alpha	3.6183	3.6183	3.6183	3.6183	3.6183	3.6183	3.6183	3.6183	3.6183	3.6183	3.6183	3.6183
util living area	0.9588	0.9439	0.9084	0.8315	0.6923	0.4807	0.3233	0.3462	0.6097	0.8413	0.9340	0.9641 (86)
MIT	19.7526	19.9018	20.2036	20.5521	20.8317	20.9679	20.9945	20.9929	20.9198	20.6030	20.1251	19.7052 (87)
Th 2	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241	20.0241 (88)
util rest of house	0.9508	0.9332	0.8905	0.7983	0.6334	0.3950	0.2234	0.2432	0.5267	0.8027	0.9193	0.9571 (89)
MIT 2	18.3967	18.6090	19.0354	19.5109	19.8631	20.0041	20.0225	20.0219	19.9633	19.5884	18.9316	18.3294 (90)
Living area fraction									fLA = Living area / (4) =			0.3642 (91)
MIT	18.8905	19.0799	19.4608	19.8901	20.2159	20.3551	20.3765	20.3755	20.3117	19.9579	19.3663	18.8305 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.7405	18.9299	19.3108	19.7401	20.0659	20.2051	20.2265	20.2255	20.1617	19.8079	19.2163	18.6805 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	596.3432	632.7255	643.6929	620.3495	510.7070	331.2497	187.2859	194.9738	376.3563	513.7585	558.9208	572.3166 (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	1103.2478	1078.1194	963.3491	795.8671	571.4888	340.1082	188.1694	196.1776	401.3020	663.8584	907.1736	1098.3903 (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	377.1370	299.3047	237.8242	126.3727	45.2216	0.0000	0.0000	0.0000	0.0000	111.6743	250.7420	391.3988 (98)
Space heating												1839.6753 (98)
RHI space heating demand												1840 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (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)			
Air changes per hour												
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	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)
Adj infilt rate	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)
Mechanical extract ventilation - decentralised	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)
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
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			6.1100	1.1450	6.9962		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			75.4800	0.1100	8.3028	75.0000	5661.0000 (28a)
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.2500	18.0600	52.8000	3814.2720 (29a)
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.0900	6.7932	9.0000	679.3200 (30)
Total net area of external elements Aum(A, m ²)			234.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.7170		(33)
Timber GF			142.3300			9.0000	1280.9700 (32c)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 11435.5620 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							151.5045 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6466 (36)
Total fabric heat loss							(33) + (36) = 51.3636 (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	29.8493	29.5533	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165 (38)
Heat transfer coeff	81.2128	80.9169	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800 (39)
Average = Sum(39)m / 12 =												80.9108 (39)
HLP	1.0760	1.0720	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715 (40)
HLP (average)												1.0720 (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												2.3715 (42)
Average daily hot water use (litres/day)												90.5234 (43)
Daily hot water use	Jan 99.5757	Feb 95.9548	Mar 92.3339	Apr 88.7129	May 85.0920	Jun 81.4711	Jul 81.4711	Aug 85.0920	Sep 88.7129	Oct 92.3339	Nov 95.9548	Dec 99.5757 (44)
Energy conte	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Energy content (annual)												Total = Sum(45)m = 1424.2854 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	22.1502	19.3727	19.9909	17.4285	16.7231	14.4308	13.3722	15.3448	15.5281	18.0965	19.7537	21.4513 (46)
Total storage loss												
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 (56)
Combi loss	14.6580	13.2129	14.5861	14.0675	14.5015	13.9934	14.4348	14.4781	14.0338	14.5511	14.1374	14.6441 (61)
Total heat required for water heating calculated for each month												
WWHRS	162.3260	142.3642	147.8587	130.2578	125.9888	110.1985	103.5830	116.7769	117.5544	135.1944	145.8290	157.6526 (62)
Total of WWHRS savings	-47.9771	-42.2113	-43.0834	-35.4643	-32.9378	-27.1781	-23.0127	-27.8593	-28.6671	-35.4264	-41.0205	-46.3684 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-431.2065
Output from w/h								Solar input	(sum of months) =	Sum (63)m =		0.0000 (63)
	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842 (64)
								Total per year (kWh/year) =	Sum (64)m =			1164.3776 (64)
Heat gains from water heating, kWh/month												
	52.7641	46.2460	47.9597	42.1501	40.6949	35.4866	33.2505	37.6339	37.9290	43.7517	47.3218	51.2114 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9468	0.9265	0.8906	0.8221	0.7069	0.5411	0.3842	0.4207	0.6370	0.8350	0.9226	0.9532 (94)
Useful gains	593.3695	638.7661	657.3612	641.3032	566.6837	420.9114	286.0589	299.1572	432.6217	531.2457	556.9291	570.7962 (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												
	1158.3996	1125.2430	1024.6231	865.2497	667.6087	449.1714	292.1538	307.7733	484.3671	732.5191	965.2586	1156.6177 (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												
	420.3824	326.9125	273.2429	161.2415	75.0882	0.0000	0.0000	0.0000	0.0000	149.7474	293.9972	435.8512 (98)
Space heating												2136.4633 (99)
Space heating per m2												28.3050 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2360.7329	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	420.3824	326.9125	273.2429	161.2415	75.0882	0.0000	0.0000	0.0000	0.0000	149.7474	293.9972	435.8512	(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)	464.5110	361.2292	301.9258	178.1674	82.9704	0.0000	0.0000	0.0000	0.0000	165.4668	324.8588	481.6035	(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	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842	(64)
Efficiency of water heater	89.7961	89.7287	89.5898	89.2883	88.7007	87.3000	87.3000	87.3000	87.3000	89.1927	89.6365	87.3000	(216)
(217)m	89.7961	89.7287	89.5898	89.2883	88.7007	87.3000	87.3000	87.3000	87.3000	89.1927	89.6365	89.8303	(217)
Fuel for water heating, kWh/month	127.3427	111.6175	116.9500	106.1657	104.9045	95.0978	92.2913	101.8529	101.8182	111.8565	116.9260	123.8828	(219)
Water heating fuel used												1310.7059	(219)
Annual totals kWh/year													
Space heating fuel - main system												2360.7329	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)												49.3125	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												124.3125	(231)
Electricity for lighting (calculated in Appendix L)												363.1807	(232)
Total delivered energy for all uses												4158.9321	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2360.7329	3.4800	82.1535 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1310.7059	3.4800	45.6126 (247)
Mechanical ventilation fans	49.3125	13.1900	6.5043 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	363.1807	13.1900	47.9035 (250)
Additional standing charges			120.0000 (251)
Total energy cost			312.0664 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0879 (257)
SAP value	84.8241	
SAP rating (Section 12)	85	(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	2360.7329	0.2160	509.9183 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1310.7059	0.2160	283.1125 (264)
Space and water heating			793.0308 (265)
Pumps and fans	124.3125	0.5190	64.5182 (267)
Energy for lighting	363.1807	0.5190	188.4908 (268)
Total kg/year			1046.0398 (272)
CO2 emissions per m2			13.8600 (273)
EI value			88.3658
EI rating			88
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8875 = 3.921$, stars = 5
Water heating environmental impact	$0.216 / 0.8875 = 0.2434$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (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)			
Air changes per hour												
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)
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
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			6.1100	1.1450	6.9962		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			75.4800	0.1100	8.3028	75.0000	5661.0000 (28a)
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.2500	18.0600	52.8000	3814.2720 (29a)
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.0900	6.7932	9.0000	679.3200 (30)
Total net area of external elements Aum(A, m2)			234.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.7170		(33)
Timber GF			142.3300			9.0000	1280.9700 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11435.5620 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							151.5045 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6466 (36)
Total fabric heat loss						(33) + (36) =	51.3636 (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	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165 (38)
Heat transfer coeff	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800 (39)
Average = Sum(39)m / 12 =												80.8800 (39)
HLP	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715 (40)
HLP (average)												1.0715 (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												2.3715 (42)
Average daily hot water use (litres/day)												90.5234 (43)
Daily hot water use	Jan 99.5757	Feb 95.9548	Mar 92.3339	Apr 88.7129	May 85.0920	Jun 81.4711	Jul 81.4711	Aug 85.0920	Sep 88.7129	Oct 92.3339	Nov 95.9548	Dec 99.5757 (44)
Energy conte	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Energy content (annual)												Total = Sum(45)m = 1424.2854 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	22.1502	19.3727	19.9909	17.4285	16.7231	14.4308	13.3722	15.3448	15.5281	18.0965	19.7537	21.4513 (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)
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	14.6580	13.2129	14.5861	14.0675	14.5015	13.9934	14.4348	14.4781	14.0338	14.5511	14.1374	14.6441 (61)
Total heat required for water heating calculated for each month	162.3260	142.3642	147.8587	130.2578	125.9888	110.1985	103.5830	116.7769	117.5544	135.1944	145.8290	157.6526 (62)
WWHRS	-47.9771	-42.2113	-43.0834	-35.4643	-32.9378	-27.1781	-23.0127	-27.8593	-28.6671	-35.4264	-41.0205	-46.3684 eq. (G10)
Total of WWHRS savings												-431.2065
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								Solar input	(sum of months) =	Sum (63)m =		0.0000 (63)
	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842 (64)
								Total per	year (kWh/year) =	Sum (64)m =		1164.3776 (64)
Heat gains from water heating, kWh/month	52.7641	46.2460	47.9597	42.1501	40.6949	35.4866	33.2505	37.6339	37.9290	43.7517	47.3218	51.2114 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.4120	45.6637	37.1362	28.1145	21.0159	17.7425	19.1714	24.9197	33.4472	42.4689	49.5675	52.8409 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	313.0383	316.2867	308.1009	290.6744	268.6766	248.0017	234.1896	230.9413	239.1270	256.5535	278.5514	299.2262 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006 (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)	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604 (71)
Water heating gains (Table 5)	70.9195	68.8185	64.4619	58.5419	54.6975	49.2869	44.6915	50.5832	52.6792	58.8060	65.7247	68.8325 (72)
Total internal gains	537.4006	532.7996	511.7298	479.3616	446.4207	417.0619	400.0833	408.4750	427.2843	459.8592	495.8744	522.9304 (73)

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

Southeast	2.6900	40.4699	0.4600	0.0000	0.7700	38.5597 (77)
Northwest	3.4200	12.9236	0.4600	0.0000	0.7700	15.6551 (81)
Southeast	3.3300	40.4699	0.4300	0.0000	0.7700	44.6206 (77)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9373	0.9182	0.8749	0.7874	0.6361	0.4115	0.2444	0.2648	0.5391	0.7928	0.9042	0.9443 (94)
Useful gains	596.3432	632.7255	643.6929	620.3495	510.7070	331.2497	187.2859	194.9738	376.3563	513.7585	558.9208	572.3166 (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												
	1103.2478	1078.1194	963.3491	795.8671	571.4888	340.1082	188.1694	196.1776	401.3020	663.8584	907.1736	1098.3903 (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												
	377.1370	299.3047	237.8242	126.3727	45.2216	0.0000	0.0000	0.0000	0.0000	111.6743	250.7420	391.3988 (98)
Space heating												1839.6753 (98)
Space heating per m2												24.3730 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2032.7904 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	377.1370	299.3047	237.8242	126.3727	45.2216	0.0000	0.0000	0.0000	0.0000	111.6743	250.7420	391.3988	(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)	416.7260	330.7234	262.7892	139.6383	49.9687	0.0000	0.0000	0.0000	0.0000	123.3970	277.0630	432.4849	(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	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842	(64)
Efficiency of water heater (217)m	89.7347	89.6759	89.4967	89.1002	88.3214	87.3000	87.3000	87.3000	87.3000	88.9614	89.5326	87.3000	(216)
Fuel for water heating, kWh/month	127.4299	111.6832	117.0716	106.3898	105.3550	95.0978	92.2913	101.8529	101.8182	112.1475	117.0618	123.9638	(219)
Water heating fuel used												1312.1628	(219)
Annual totals kWh/year													
Space heating fuel - main system												2032.7904	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)													49.3125 (230a)
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													124.3125 (231)
Electricity for lighting (calculated in Appendix L)													363.1807 (232)
Total delivered energy for all uses													3832.4464 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2032.7904	3.9200	79.6854 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1312.1628	3.9200	51.4368 (247)
Mechanical ventilation fans	49.3125	16.9600	8.3634 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	363.1807	16.9600	61.5955 (250)
Additional standing charges			88.0000 (251)
Total energy cost			301.8010 (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	2032.7904	0.2160	439.0827 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1312.1628	0.2160	283.4272 (264)
Space and water heating			722.5099 (265)
Pumps and fans	124.3125	0.5190	64.5182 (267)
Energy for lighting	363.1807	0.5190	188.4908 (268)
Total kg/year			975.5189 (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	2032.7904	1.2200	2480.0043 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1312.1628	1.2200	1600.8386 (264)
Space and water heating			4080.8429 (265)
Pumps and fans	124.3125	3.0700	381.6394 (267)
Energy for lighting	363.1807	3.0700	1114.9648 (268)
Primary energy kWh/year			5577.4471 (272)
Primary energy kWh/m2/year			73.8930 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Current energy efficiency rating: B 85
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	+ 11.1	-£ 309	-947 kg (97.0%)

Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 20	-132 kg (13.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309	12.54 kg/m²	A 96
Total Savings	£309	12.54 kg/m²	A 98
Potential energy efficiency rating:			A 96
Potential environmental impact rating:			A 98

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	£83	£83	£0
Mains gas	£219	£219	£0
Space heating	£189	£189	£0
Water heating	£51	£51	£0
Lighting	£62	£62	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£302	-£7	£309
Total cost of uses	£302	-£7	£309
Delivered energy	51 kWh/m²	27 kWh/m²	24 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.0 tonnes	0.9 tonnes
CO2 emissions per m²	13 kg/m²	0 kg/m²	13 kg/m²
Primary energy	74 kWh/m²	0 kWh/m²	74 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	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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)

	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	0.2556	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												0.5000 (23a)
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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.1500	1.0000	2.1500		(26)	
Window (Uw = 1.20)			6.1100	1.1450	6.9962		(27)	
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)	
FP McCann System			75.4800	0.1100	8.3028	75.0000	5661.0000 (28a)	
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.2500	18.0600	52.8000	3814.2720 (29a)	
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.0900	6.7932	9.0000	679.3200 (30)	
Total net area of external elements Aum(A, m2)			234.7900					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.7170				(33)
Timber GF			142.3300					9.0000 1280.9700 (32c)

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	29.8493	29.5533	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165 (38)
Heat transfer coeff	81.2128	80.9169	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800 (39)
Average = Sum(39)m / 12 =												80.9108 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0760	1.0720	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715 (40)
HLP (average)												1.0720 (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												2.3715 (42)
Average daily hot water use (litres/day)												90.5234 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.5757	95.9548	92.3339	88.7129	85.0920	81.4711	81.4711	85.0920	88.7129	92.3339	95.9548	99.5757 (44)
Energy conte	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Energy content (annual)												Total = Sum(45)m = 1424.2854 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	22.1502	19.3727	19.9909	17.4285	16.7231	14.4308	13.3722	15.3448	15.5281	18.0965	19.7537	21.4513 (46)
Total storage loss												
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 (56)
Combi loss	14.6580	13.2129	14.5861	14.0675	14.5015	13.9934	14.4348	14.4781	14.0338	14.5511	14.1374	14.6441 (61)
Total heat required for water heating calculated for each month												
WWHRS	162.3260	142.3642	147.8587	130.2578	125.9888	110.1985	103.5830	116.7769	117.5544	135.1944	145.8290	157.6526 (62)
Total of WWHRS savings	-47.9771	-42.2113	-43.0834	-35.4643	-32.9378	-27.1781	-23.0127	-27.8593	-28.6671	-35.4264	-41.0205	-46.3684 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-431.2065
Output from w/h								Solar input	(sum of months) =	Sum (63)m =		0.0000 (63)
	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842 (64)
								Total per year (kWh/year) =	Sum (64)m =			1164.3776 (64)
Heat gains from water heating, kWh/month												
	52.7641	46.2460	47.9597	42.1501	40.6949	35.4866	33.2505	37.6339	37.9290	43.7517	47.3218	51.2114 (65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9468	0.9265	0.8906	0.8221	0.7069	0.5411	0.3842	0.4207	0.6370	0.8350	0.9226	0.9532 (94)
Useful gains	593.3695	638.7661	657.3612	641.3032	566.6837	420.9114	286.0589	299.1572	432.6217	531.2457	556.9291	570.7962 (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												
	1158.3996	1125.2430	1024.6231	865.2497	667.6087	449.1714	292.1538	307.7733	484.3671	732.5191	965.2586	1156.6177 (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												
	420.3824	326.9125	273.2429	161.2415	75.0882	0.0000	0.0000	0.0000	0.0000	149.7474	293.9972	435.8512 (98)
Space heating												2136.4633 (99)
Space heating per m2												28.3050 (99)
										(98) / (4) =		

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2360.7329	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	420.3824	326.9125	273.2429	161.2415	75.0882	0.0000	0.0000	0.0000	0.0000	149.7474	293.9972	435.8512	(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)	464.5110	361.2292	301.9258	178.1674	82.9704	0.0000	0.0000	0.0000	0.0000	165.4668	324.8588	481.6035	(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	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842	(64)
Efficiency of water heater (217)m	89.7961	89.7287	89.5898	89.2883	88.7007	87.3000	87.3000	87.3000	87.3000	89.1927	89.6365	87.3000	(216)
Fuel for water heating, kWh/month	127.3427	111.6175	116.9500	106.1657	104.9045	95.0978	92.2913	101.8529	101.8182	111.8565	116.9260	123.8828	(219)
Water heating fuel used												1310.7059	(219)
Annual totals kWh/year													
Space heating fuel - main system												2360.7329	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)												49.3125	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												124.3125	(231)
Electricity for lighting (calculated in Appendix L)												363.1807	(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												2431.6927	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2360.7329	3.4800	82.1535 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1310.7059	3.4800	45.6126 (247)
Mechanical ventilation fans	49.3125	13.1900	6.5043 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	363.1807	13.1900	47.9035 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			84.2436 (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] =	0.2937 (257)
SAP value		95.9032
SAP rating (Section 12)		96 (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	2360.7329	0.2160	509.9183 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1310.7059	0.2160	283.1125 (264)
Space and water heating			793.0308 (265)
Pumps and fans	124.3125	0.5190	64.5182 (267)
Energy for lighting	363.1807	0.5190	188.4908 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			149.6025 (272)
CO2 emissions per m2			1.9800 (273)
EI value			98.3361
EI rating			98 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	75.4800 (1b)	x 2.3700 (2b)	= 178.8876 (1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	75.4800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 178.8876 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	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												0.5000 (23a)
If mechanical ventilation:												
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K
Solid Door			2.1500	1.0000	2.1500		(26)
Window (Uw = 1.20)			6.1100	1.1450	6.9962		(27)
French Door (Uw = 1.40)			3.3300	1.3258	4.4148		(27)
FP McCann System			75.4800	0.1100	8.3028	75.0000	5661.0000 (28a)
100mm Knauf Supafil 34	83.8300	11.5900	72.2400	0.2500	18.0600	52.8000	3814.2720 (29a)
Plane Ceiling-500mm Loft Roll	75.4800		75.4800	0.0900	6.7932	9.0000	679.3200 (30)
Total net area of external elements Aum(A, m2)			234.7900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.7170		(33)
Timber GF			142.3300			9.0000	1280.9700 (32c)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		11435.5620 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							151.5045 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.6466 (36)
Total fabric heat loss						(33) + (36) =	51.3636 (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	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165	29.5165 (38)
Heat transfer coeff	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800	80.8800 (39)
Average = Sum(39)m / 12 =												80.8800 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715	1.0715 (40)
HLP (average)												1.0715 (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												2.3715 (42)
Average daily hot water use (litres/day)												90.5234 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	99.5757	95.9548	92.3339	88.7129	85.0920	81.4711	81.4711	85.0920	88.7129	92.3339	95.9548	99.5757 (44)
Energy conte	147.6679	129.1513	133.2726	116.1903	111.4873	96.2051	89.1482	102.2988	103.5206	120.6433	131.6916	143.0085 (45)
Energy content (annual)												Total = Sum(45)m = 1424.2854 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	22.1502	19.3727	19.9909	17.4285	16.7231	14.4308	13.3722	15.3448	15.5281	18.0965	19.7537	21.4513 (46)
Total storage loss												
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 (56)
Combi loss	14.6580	13.2129	14.5861	14.0675	14.5015	13.9934	14.4348	14.4781	14.0338	14.5511	14.1374	14.6441 (61)
Total heat required for water heating calculated for each month												
WWHRS	162.3260	142.3642	147.8587	130.2578	125.9888	110.1985	103.5830	116.7769	117.5544	135.1944	145.8290	157.6526 (62)
Total of WWHRS savings	-47.9771	-42.2113	-43.0834	-35.4643	-32.9378	-27.1781	-23.0127	-27.8593	-28.6671	-35.4264	-41.0205	-46.3684 eq. (G10)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-431.2065
Output from w/h								Solar input	(sum of months) =	Sum (63)m =		0.0000 (63)
	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842 (64)
								Total per year (kWh/year) =	Sum (64)m =			1164.3776 (64)
Heat gains from water heating, kWh/month												
	52.7641	46.2460	47.9597	42.1501	40.6949	35.4866	33.2505	37.6339	37.9290	43.7517	47.3218	51.2114 (65)

Metabolic gains (Table 5), Watts													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	142.2907	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	51.4120	45.6637	37.1362	28.1145	21.0159	17.7425	19.1714	24.9197	33.4472	42.4689	49.5675	52.8409	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	313.0383	316.2867	308.1009	290.6744	268.6766	248.0017	234.1896	230.9413	239.1270	256.5535	278.5514	299.2262	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	51.6006	(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)	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	-94.8604	(71)
Water heating gains (Table 5)	70.9195	68.8185	64.4619	58.5419	54.6975	49.2869	44.6915	50.5832	52.6792	58.8060	65.7247	68.8325	(72)
Total internal gains	537.4006	532.7996	511.7298	479.3616	446.4207	417.0619	400.0833	408.4750	427.2843	459.8592	495.8744	522.9304	(73)

[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
Southeast	2.6900	40.4699	0.4600	0.0000	0.7700	38.5597 (77)
Northwest	3.4200	12.9236	0.4600	0.0000	0.7700	15.6551 (81)
Southeast	3.3300	40.4699	0.4300	0.0000	0.7700	44.6206 (77)

Regs Region: England
Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2032.7904 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	377.1370	299.3047	237.8242	126.3727	45.2216	0.0000	0.0000	0.0000	0.0000	111.6743	250.7420	391.3988	(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)	416.7260	330.7234	262.7892	139.6383	49.9687	0.0000	0.0000	0.0000	0.0000	123.3970	277.0630	432.4849	(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	114.3488	100.1529	104.7752	94.7935	93.0510	83.0204	80.5703	88.9175	88.8873	99.7679	104.8084	111.2842	(64)
Efficiency of water heater (217)m	89.7347	89.6759	89.4967	89.1002	88.3214	87.3000	87.3000	87.3000	87.3000	88.9614	89.5326	87.3000	(216)
Fuel for water heating, kWh/month	127.4299	111.6832	117.0716	106.3898	105.3550	95.0978	92.2913	101.8529	101.8182	112.1475	117.0618	123.9638	(219)
Water heating fuel used												1312.1628	(219)
Annual totals kWh/year													
Space heating fuel - main system												2032.7904	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(MEV)Decentralised, Database: total watage = 4.7450, total flow = 21.0000, SFP = 0.2260)													
mechanical ventilation fans (SFP = 0.2260)												49.3125	(230a)
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												124.3125	(231)
Electricity for lighting (calculated in Appendix L)												363.1807	(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												2008.2868	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2032.7904	3.9200	79.6854 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1312.1628	3.9200	51.4368 (247)
Mechanical ventilation fans	49.3125	16.9600	8.3634 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	363.1807	16.9600	61.5955 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			-7.5765 (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	2032.7904	0.2160	439.0827 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1312.1628	0.2160	283.4272 (264)
Space and water heating			722.5099 (265)
Pumps and fans	124.3125	0.5190	64.5182 (267)
Energy for lighting	363.1807	0.5190	188.4908 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			28.7800 (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	2032.7904	1.2200	2480.0043 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1312.1628	1.2200	1600.8386 (264)
Space and water heating			4080.8429 (265)
Pumps and fans	124.3125	3.0700	381.6394 (267)
Energy for lighting	363.1807	3.0700	1114.9648 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Primary energy kWh/year -22.7230 (272)
 Primary energy kWh/m2/year -0.3010 (273)

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

Overheating Calculation Input Data

Dwelling type Detached Bungalow
 Number of storeys 1
 Cross ventilation possible Yes
 SAP Region Thames Valley
 Front of dwelling faces North West
 Overshading Average or unknown
 Thermal mass parameter 151.5 (calculated from construction elements)
 Night ventilation No
 Ventilation rate during hot weather (ach) 3.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient 177.10 (P1)
 Transmission heat loss coefficient 51.36 (37)
 Summer heat loss coefficient 228.46 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b g	Specific data or Table 6c FF	Shading	Gains W
South East	2.6900	119.9223	0.4600	0.0000	0.9000	133.5527
North West	3.4200	98.8453	0.4600	0.0000	0.9000	139.9530
South East	3.3300	119.9223	0.4300	0.0000	0.9000	154.5451

total: 428.0509

	Jun	Jul	Aug	
Solar gains	454	428	383	(P3/P4)
Internal gains	414	397	405	
Total summer gains	868	825	789	(P5)
Summer gain/loss ratio	3.80	3.61	3.45	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 151.5)	0.94	0.94	0.94	
Threshold temperature	20.74	22.45	22.19	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			