

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	Emmett - Semi_A			Issued on Date	15/12/2022
Assessment Reference	Emmett - Semi_A	Prop Type Ref			
Property	Plot, 3 Bed, K, WC, B, ES				
SAP Rating	85 B	DER	14.61	TER	19.11
Environmental	89 B	% DER<TER	23.55		
CO ₂ Emissions (t/year)	0.88	DFEE	41.15	TFEE	53.00
General Requirements Compliance	Pass	% DFEE<TFEE	22.35		
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

Semi-Detached House, total floor area 72 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) 19.11 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 14.61 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)41.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.18 (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 North East: 3.94 m², No overhang
Windows facing South West: 7.29 m², No overhang
Windows facing North West: 0.66 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value	0.00 W/m ² K
Roof U-value	0.09 W/m ² K
Floor U-value	0.11 W/m ² K
Door U-value	1.00 W/m ² K
Door U-value	0.90 W/m ² K
Window U-value	0.90 W/m ² K
Thermal bridging y-value	0.034 W/m ² K

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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	36.4000 (1b)	x 2.3100 (2b)	= 84.0840 (1b) - (3b)
First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000 (28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360 (29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500 (30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500 (30)
Total net area of external elements Aum(A, m ²)			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2113		(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			55.3000			9.0000	497.7000 (32c)
Timber FF			93.9900			9.0000	845.9100 (32c)
Internal Floor			35.1600			12.6000	443.0160 (32d)
Internal Ceiling			35.1600			9.0000	316.4400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10525.6020 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							147.0878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3394 (36)
Total fabric heat loss						(33) + (36) =	46.5507 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.0155	Feb 29.0155	Mar 29.0155	Apr 29.0155	May 29.0155	Jun 29.0155	Jul 29.0155	Aug 29.0155	Sep 29.0155	Oct 29.0155	Nov 29.0155	Dec 29.0155 (38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662 (39)
Average = Sum(39)m / 12 =												75.5662 (39)
HLP	Jan 1.0560	Feb 1.0560	Mar 1.0560	Apr 1.0560	May 1.0560	Jun 1.0560	Jul 1.0560	Aug 1.0560	Sep 1.0560	Oct 1.0560	Nov 1.0560	Dec 1.0560 (40)
HLP (average)												1.0560 (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	2.2834 (42)
Average daily hot water use (litres/day)	88.4306 (43)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total =	Sum (45)m =	1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(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	14.6379	13.1959	14.5692	14.0534	14.4885	13.9827	14.4248	14.4661	14.0212	14.5358	14.1201	14.6246	(61)
Total heat required for water heating calculated for each month	158.8919	139.3614	144.7607	127.5575	123.3984	107.9637	101.5120	114.3999	115.1486	132.3900	142.7671	154.3269	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq. (G10)
Total of WWHRS savings												-417.7106	
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	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178	(64)
Heat gains from water heating, kWh/month	51.6239	45.2490	46.9310	41.2535	39.8347	34.7443	32.5627	36.8445	37.1301	42.8205	46.3052	50.1072	(65)
										Total per year (kWh/year) =	Sum (64)m =	1144.7675	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5511	16.4770	13.4000	10.1446	7.5832	6.4021	6.9177	8.9919	12.0689	15.3242	17.8856	19.0667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.9103	202.9951	197.7414	186.5569	172.4386	159.1693	150.3046	148.2198	153.4735	164.6579	178.7763	192.0456	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	(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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)	69.3870	67.3348	63.0793	57.2965	53.5412	48.2560	43.7671	49.5222	51.5696	57.5544	64.3127	67.3484	(72)
Total internal gains	349.0993	347.0578	334.4715	314.2490	293.8139	274.0783	261.2403	266.9848	277.3629	297.7874	321.2255	338.7116	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
Northeast				3.9400	11.2829	0.4600	0.0000	0.7700	15.7459 (75)				
Southwest				4.1400	36.7938	0.4600	0.0000	0.7700	53.9540 (79)				
Northwest				0.6600	11.2829	0.4600	0.0000	0.7700	2.6376 (81)				
Southwest				3.1500	36.7938	0.4300	0.0000	0.7700	38.3747 (79)				
Solar gains	110.7122	194.6902	282.6029	377.3448	447.4718	455.1508	434.2717	380.2851	315.1498	219.5472	133.7197	94.0270	(83)
Total gains	459.8116	541.7479	617.0744	691.5937	741.2857	729.2291	695.5119	647.2698	592.5127	517.3346	454.9452	432.7386	(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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area	0.9827	0.9686	0.9397	0.8757	0.7603	0.6026	0.4597	0.5085	0.7292	0.9103	0.9710	0.9859 (86)	
MIT	19.3829	19.6188	19.9703	20.3838	20.7222	20.9118	20.9745	20.9632	20.8216	20.3712	19.7851	19.3175 (87)	
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369 (88)	
util rest of house	0.9793	0.9625	0.9279	0.8511	0.7142	0.5294	0.3665	0.4130	0.6629	0.8870	0.9643	0.9831 (89)	
MIT 2	17.8766	18.2172	18.7202	19.2974	19.7428	19.9644	20.0228	20.0150	19.8736	19.2936	18.4614	17.7818 (90)	
Living area fraction									fLA = Living area / (4) =				0.2513 (91)
MIT	18.2551	18.5694	19.0343	19.5704	19.9889	20.2025	20.2619	20.2532	20.1118	19.5644	18.7940	18.1677 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.1051	18.4194	18.8843	19.4204	19.8389	20.0525	20.1119	20.1032	19.9618	19.4144	18.6440	18.0177 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9695	0.9487	0.9099	0.8325	0.7037	0.5307	0.3740	0.4199	0.6571	0.8682	0.9510	0.9745 (94)
Useful gains	445.7843	513.9512	561.4790	575.7809	521.6091	386.9660	260.1001	271.7671	389.3341	449.1431	432.6386	421.7159 (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	1043.1970	1021.6075	935.8349	794.9843	615.0272	412.0224	265.3809	279.8370	442.9513	666.0671	872.3357	1044.1484 (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												

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444.4750	341.1451	278.5208	157.8265	69.5031	0.0000	0.0000	0.0000	0.0000	161.3914	316.5819	463.0898 (98)
Space heating											2232.5336 (98)
Space heating per m2									(98) / (4) =		31.1981 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												2466.8880 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	444.4750	341.1451	278.5208	157.8265	69.5031	0.0000	0.0000	0.0000	0.0000	161.3914	316.5819	463.0898 (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)	491.1327	376.9559	307.7578	174.3939	76.7990	0.0000	0.0000	0.0000	0.0000	178.3331	349.8142	511.7014 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178 (64)
Efficiency of water heater	89.8352	89.7630	89.6130	89.2849	88.6533	87.3000	87.3000	87.3000	87.3000	89.2633	89.6927	87.3000 (216)
(217)m	89.8352	89.7630	89.6130	89.2849	88.6533	87.3000	87.3000	87.3000	87.3000	89.2633	89.6927	89.8704 (217)
Fuel for water heating, kWh/month	125.1440	109.7092	114.9749	104.3888	103.1985	93.5076	90.7361	100.1206	100.0834	109.8647	114.8718	121.7506 (219)
Water heating fuel used												1288.3502 (219)
Annual totals kWh/year												
Space heating fuel - main system												2466.8880 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												49.2222 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												124.2222 (231)
Electricity for lighting (calculated in Appendix L)												327.6189 (232)
Total delivered energy for all uses												4207.0792 (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	2466.8880	0.2160	532.8478 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1288.3502	0.2160	278.2836 (264)
Space and water heating			811.1314 (265)
Pumps and fans	124.2222	0.5190	64.4713 (267)
Energy for lighting	327.6189	0.5190	170.0342 (268)
Total CO2, kg/year			1045.6370 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.6100 (273)

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

DER			14.6100 ZC1
Total Floor Area		TFA	71.5600
Assumed number of occupants		N	2.2834
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			16.6371 ZC2
CO2 emissions from cooking, equation (L16)			2.4288 ZC3
Total CO2 emissions			33.6759 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			33.6759 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)
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First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1706 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4206 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3891 (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	0.4960	0.4863	0.4766	0.4280	0.4182	0.3696	0.3696	0.3599	0.3891	0.4182	0.4377	0.4571 (22b)
Effective ac	0.6230	0.6183	0.6136	0.5916	0.5875	0.5683	0.5683	0.5648	0.5757	0.5875	0.5958	0.6045 (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			1.9800	1.0000	1.9800		(26)
TER Opening Type (Uw = 1.40)			11.8900	1.3258	15.7633		(27)
FP McCann System			36.4000	0.1300	4.7320		(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.1800	12.7116		(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.1300	4.5695		(30)
Porch Roof - 200mm	1.2500		1.2500	0.1300	0.1625		(30)
Total net area of external elements Aum(A, m ²)			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	39.9189	(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)							9.7628 (36)
Total fabric heat loss						(33) + (36) =	49.6817 (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	36.1550	35.8778	35.6061	34.3297	34.0909	32.9792	32.9792	32.7733	33.4074	34.0909	34.5740	35.0790 (38)
Heat transfer coeff	85.8367	85.5595	85.2877	84.0113	83.7725	82.6608	82.6608	82.4550	83.0890	83.7725	84.2556	84.7607 (39)
Average = Sum(39)m / 12 =												84.0102 (39)
HLP	1.1995	1.1956	1.1918	1.1740	1.1707	1.1551	1.1551	1.1522	1.1611	1.1707	1.1774	1.1845 (40)
HLP (average)												1.1740 (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												2.2834 (42)
Average daily hot water use (litres/day)												88.4306 (43)
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737 (44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023 (45)
Energy content (annual)										Total = Sum(45)m =		1391.3579 (45)
Distribution loss (46)m = 0.15 x (45)m	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	49.5696	43.1444	45.9645	42.7374	42.3595	39.2487	40.5569	42.3595	42.7374	45.9645	46.2262	49.5696	(61)	
Total heat required for water heating calculated for each month	193.8237	169.3100	176.1560	156.2415	151.2694	133.2296	127.6441	142.2933	143.8648	163.8187	174.8732	189.2719	(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	193.8237	169.3100	176.1560	156.2415	151.2694	133.2296	127.6441	Solar input (sum of months) = Sum (63)m =					0.0000 (63)	
Heat gains from water heating, kWh/month	60.3569	52.7361	54.7798	48.4245	46.8024	41.0608	39.0957	43.8179	44.3092	50.6776	54.3317	58.8434	(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	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5511	16.4770	13.4000	10.1446	7.5832	6.4021	6.9177	8.9919	12.0689	15.3242	17.8856	19.0667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.9103	202.9951	197.7414	186.5569	172.4386	159.1693	150.3046	148.2198	153.4735	164.6579	178.7763	192.0456	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	(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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)	81.1248	78.4764	73.6288	67.2562	62.9065	57.0289	52.5480	58.8950	61.5405	68.1151	75.4607	79.0906	(72)
Total internal gains	360.8371	358.1994	345.0211	324.2087	303.1792	282.8512	270.0212	276.3575	287.3338	308.3481	332.3735	350.4538	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.9400	11.2829	0.6300	0.7000	0.7700	13.5860 (75)			
Southwest				7.2900	36.7938	0.6300	0.7000	0.7700	81.9737 (79)			
Northwest				0.6600	11.2829	0.6300	0.7000	0.7700	2.2758 (81)			
Solar gains	97.8355	171.9186	249.2210	332.2538	393.5622	400.1339	381.8525	334.6739	277.7490	193.7800	118.1438	83.1059 (83)
Total gains	458.6726	530.1180	594.2421	656.4625	696.7414	682.9851	651.8737	611.0314	565.0828	502.1281	450.5173	433.5598 (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	57.8942	58.0818	58.2668	59.1521	59.3207	60.1185	60.1185	60.2686	59.8087	59.3207	58.9806	58.6291	
alpha	4.8596	4.8721	4.8845	4.9435	4.9547	5.0079	5.0079	5.0179	4.9872	4.9547	4.9320	4.9086	
util living area	0.9973	0.9941	0.9853	0.9559	0.8749	0.7126	0.5443	0.5979	0.8389	0.9713	0.9945	0.9980	(86)
MIT	19.7305	19.8930	20.1519	20.4917	20.7784	20.9445	20.9883	20.9817	20.8700	20.4986	20.0557	19.7071	(87)
Th 2	19.9204	19.9235	19.9265	19.9409	19.9435	19.9561	19.9561	19.9584	19.9512	19.9435	19.9381	19.9324	(88)
util rest of house	0.9964	0.9921	0.9801	0.9393	0.8284	0.6201	0.4222	0.4738	0.7648	0.9572	0.9922	0.9973	(89)
MIT 2	18.2368	18.4757	18.8530	19.3458	19.7263	19.9192	19.9518	19.9509	19.8476	19.3650	18.7242	18.2111	(90)
Living area fraction	18.6121	18.8318	19.1794	19.6337	19.9907	20.1768	20.2122	20.2099	20.1045	19.6498	19.0587	18.5870	(92)
Temperature adjustment													
adjusted MIT	18.6121	18.8318	19.1794	19.6337	19.9907	20.1768	20.2122	20.2099	20.1045	19.6498	19.0587	18.5870	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	456.2706	524.3885	579.4308	612.6518	578.8108	437.8839	295.3170	308.6277	439.1809	478.0384	445.7757	431.8112	(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	1228.5015	1191.9953	1081.3948	901.7516	694.5289	460.9864	298.5898	314.1463	498.9085	758.1286	1007.5898	1219.4522	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	574.5398	448.6318	373.4612	208.1518	86.0943	0.0000	0.0000	0.0000	0.0000	208.3871	404.5061	586.0049	(98)
Space heating												2889.7769	(98)
Space heating per m2												40.3826	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3093.9796 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	574.5398	448.6318	373.4612	208.1518	86.0943	0.0000	0.0000	0.0000	0.0000	208.3871	404.5061	586.0049	(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)	615.1390	480.3338	399.8514	222.8606	92.1780	0.0000	0.0000	0.0000	0.0000	223.1125	433.0900	627.4142	(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	193.8237	169.3100	176.1560	156.2415	151.2694	133.2296	127.6441	142.2933	143.8648	163.8187	174.8732	189.2719	(64)
Efficiency of water heater (217)m	87.6200	87.3884	86.8969	85.7742	83.6915	80.3000	80.3000	80.3000	80.3000	85.6581	87.0936	87.7068	(216)
Fuel for water heating, kWh/month	221.2094	193.7442	202.7184	182.1545	180.7464	165.9148	158.9591	177.2021	179.1591	191.2472	200.7876	215.8008	(219)
Water heating fuel used												2269.6436	(219)
Annual totals kWh/year													
Space heating fuel - main system												3093.9796	(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)												327.6189	(232)
Total delivered energy for all uses												5766.2420	(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	3093.9796	0.2160	668.2996 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2269.6436	0.2160	490.2430 (264)
Space and water heating			1158.5426 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	327.6189	0.5190	170.0342 (268)
Total CO2, kg/m2/year			1367.5018 (272)
Emissions per m2 for space and water heating			16.1898 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3761 (272b)
Emissions per m2 for pumps and fans			0.5439 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1898 * 1.00) + 2.3761 + 0.5439, rounded to 2 d.p.			19.1100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.4000 (1b)	x 2.3100 (2b)	= 84.0840 (1b) - (3b)
First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (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) = 0.1706 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3711 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3433 (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	0.4377	0.4291	0.4205	0.3776	0.3690	0.3261	0.3261	0.3175	0.3433	0.3690	0.3862	0.4033 (22b)
Effective ac	0.5958	0.5921	0.5884	0.5713	0.5681	0.5532	0.5532	0.5504	0.5589	0.5681	0.5746	0.5813 (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			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000 (28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360 (29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500 (30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500 (30)
Total net area of external elements Aum(A, m ²)			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.2113		(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			55.3000			9.0000	497.7000 (32c)
Timber FF			93.9900			9.0000	845.9100 (32c)
Internal Floor			35.1600			12.6000	443.0160 (32d)
Internal Ceiling			35.1600			9.0000	316.4400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10525.6020 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.0878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3394 (36)
Total fabric heat loss						(33) + (36) =	46.5507 (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	34.5734	34.3576	34.1461	33.1524	32.9665	32.1011	32.1011	31.9408	32.4345	32.9665	33.3426	33.7358 (38)
Heat transfer coeff	81.1241	80.9083	80.6968	79.7031	79.5172	78.6518	78.6518	78.4915	78.9852	79.5172	79.8933	80.2865 (39)
Average = Sum(39)m / 12 =												79.7022 (39)
HLP	1.1337	1.1306	1.1277	1.1138	1.1112	1.0991	1.0991	1.0969	1.1038	1.1112	1.1165	1.1219 (40)
HLP (average)												1.1138 (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												2.2834 (42)
Average daily hot water use (litres/day)												88.4306 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023 (45)
Energy content (annual)										Total =	Sum (45)m =	1391.3579 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.6540	26.8102	27.6657	24.1196	23.1434	19.9710	18.5060	21.2359	21.4896	25.0440	27.3375	29.6867 (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	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5511	16.4770	13.4000	10.1446	7.5832	6.4021	6.9177	8.9919	12.0689	15.3242	17.8856	19.0667 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.9103	202.9951	197.7414	186.5569	172.4386	159.1693	150.3046	148.2198	153.4735	164.6579	178.7763	192.0456 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170 (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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358 (71)
Water heating gains (Table 5)	41.2016	39.8961	37.1851	33.4995	31.1067	27.7374	24.8737	28.5429	29.8466	33.6613	37.9687	39.9015 (72)
Total internal gains	317.9139	316.6190	305.5773	287.4520	268.3794	250.5597	239.3469	243.0055	252.6398	270.8943	291.8815	308.2648 (73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			3.9400		11.2829		0.4600		0.0000		0.7700	15.7459 (75)
Southwest			4.1400		36.7938		0.4600		0.0000		0.7700	53.9540 (79)
Northwest			0.6600		11.2829		0.4600		0.0000		0.7700	2.6376 (81)
Southwest			3.1500		36.7938		0.4300		0.0000		0.7700	38.3747 (79)
Solar gains	110.7122	194.6902	282.6029	377.3448	447.4718	455.1508	434.2717	380.2851	315.1498	219.5472	133.7197	94.0270 (83)
Total gains	428.6261	511.3092	588.1802	664.7967	715.8511	705.7105	673.6185	623.2905	567.7896	490.4416	425.6013	402.2918 (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	36.0408	36.1369	36.2317	36.6834	36.7691	37.1737	37.1737	37.2496	37.0168	36.7691	36.5960	36.4168
alpha	3.4027	3.4091	3.4154	3.4456	3.4513	3.4782	3.4782	3.4833	3.4678	3.4513	3.4397	3.4278
util living area	0.9863	0.9745	0.9501	0.8934	0.7878	0.6323	0.4878	0.5394	0.7600	0.9257	0.9769	0.9889 (86)
MIT	19.1787	19.4269	19.8036	20.2721	20.6548	20.8873	20.9655	20.9510	20.7765	20.2667	19.6360	19.1357 (87)
Th 2	19.9734	19.9759	19.9783	19.9896	19.9917	20.0016	20.0016	20.0034	19.9978	19.9917	19.9874	19.9830 (88)
util rest of house	0.9835	0.9694	0.9398	0.8706	0.7425	0.5563	0.3874	0.4375	0.6941	0.9050	0.9713	0.9865 (89)
MIT 2	18.3125	18.5597	18.9313	19.3902	19.7403	19.9379	19.9885	19.9834	19.8564	19.3960	18.7776	18.2769 (90)
Living area fraction									fLA =	Living area / (4) =		0.2513 (91)
MIT	18.5301	18.7776	19.1505	19.6118	19.9701	20.1765	20.2340	20.2265	20.0876	19.6148	18.9933	18.4927 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5301	18.7776	19.1505	19.6118	19.9701	20.1765	20.2340	20.2265	20.0876	19.6148	18.9933	18.4927 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9781	0.9615	0.9293	0.8607	0.7414	0.5704	0.4117	0.4615	0.7007	0.8955	0.9641	0.9820 (94)
Useful gains	419.2511	491.6353	546.6174	572.2071	530.7194	402.5721	277.2965	287.6300	397.8287	439.1789	410.3376	395.0324 (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	1154.4075	1122.8117	1020.8516	853.7620	657.6156	438.5980	285.8218	300.3472	472.9308	716.8294	950.1929	1147.5068 (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	546.9564	424.1505	352.8302	202.7196	94.4108	0.0000	0.0000	0.0000	0.0000	206.5720	388.6958	559.8410 (98)
Space heating												2776.1763 (98)
Space heating per m2										(98) / (4) =		38.7951 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b

Ext. temp.	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	739.3270	582.0234	596.5358	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8496	0.9022	0.8794	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	628.1202	525.1207	524.6204	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	909.9549	870.7450	813.3868	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	202.9210	257.1445	214.8422	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												674.9077	(104)
Cooled fraction									FC = cooled area / (4) =			1.0000	(105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	50.7302	64.2861	53.7106	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												168.7269	(107)
Space cooling per m2												2.3578	(108)
Energy for space heating												38.7951	(99)
Energy for space cooling												2.3578	(108)
Total												41.1529	(109)
Dwelling Fabric Energy Efficiency (DFEE)												41.2	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.4000 (1b)	x 2.3100 (2b)	= 84.0840 (1b) - (3b)
First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1706 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4206 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3891 (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	0.4960	0.4863	0.4766	0.4280	0.4182	0.3696	0.3696	0.3599	0.3891	0.4182	0.4377	0.4571 (22b)
Effective ac	0.6230	0.6183	0.6136	0.5916	0.5875	0.5683	0.5683	0.5648	0.5757	0.5875	0.5958	0.6045 (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			1.9800	1.0000	1.9800		(26)
TER Opening Type (Uw = 1.40)			11.8900	1.3258	15.7633		(27)
FP McCann System			36.4000	0.1300	4.7320		(28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.1800	12.7116		(29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.1300	4.5695		(30)
Porch Roof - 200mm	1.2500		1.2500	0.1300	0.1625		(31)
Total net area of external elements Aum, m ²			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.9189		(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)							9.7628 (36)
Total fabric heat loss						(33) + (36) =	49.6817 (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	36.1550	35.8778	35.6061	34.3297	34.0909	32.9792	32.9792	32.7733	33.4074	34.0909	34.5740	35.0790 (38)
Heat transfer coeff	85.8367	85.5595	85.2877	84.0113	83.7725	82.6608	82.6608	82.4550	83.0890	83.7725	84.2556	84.7607 (39)
Average = Sum(39)m / 12 =												84.0102 (39)
HLP	1.1995	1.1956	1.1918	1.1740	1.1707	1.1551	1.1551	1.1522	1.1611	1.1707	1.1774	1.1845 (40)
HLP (average)												1.1740 (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												2.2834 (42)
Average daily hot water use (litres/day)												88.4306 (43)
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737 (44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023 (45)
Energy content (annual)										Total = Sum(45)m =		1391.3579 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.6540	26.8102	27.6657	24.1196	23.1434	19.9710	18.5060	21.2359	21.4896	25.0440	27.3375	29.6867 (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	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	114.1697	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.5511	16.4770	13.4000	10.1446	7.5832	6.4021	6.9177	8.9919	12.0689	15.3242	17.8856	19.0667	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	200.9103	202.9951	197.7414	186.5569	172.4386	159.1693	150.3046	148.2198	153.4735	164.6579	178.7763	192.0456	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	34.4170	(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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)	41.2016	39.8961	37.1851	33.4995	31.1067	27.7374	24.8737	28.5429	29.8466	33.6613	37.9687	39.9015	(72)
Total internal gains	317.9139	316.6190	305.5773	287.4520	268.3794	250.5597	239.3469	243.0055	252.6398	270.8943	291.8815	308.2648	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	3.9400	11.2829	0.6300	0.7000	0.7700	13.5860 (75)
Southwest	7.2900	36.7938	0.6300	0.7000	0.7700	81.9737 (79)
Northwest	0.6600	11.2829	0.6300	0.7000	0.7700	2.2758 (81)

Solar gains	97.8355	171.9186	249.2210	332.2538	393.5622	400.1339	381.8525	334.6739	277.7490	193.7800	118.1438	83.1059	(83)
Total gains	415.7494	488.5376	554.7984	619.7057	661.9416	650.6936	621.1994	577.6794	530.3889	464.6743	410.0253	391.3707	(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	57.8942	58.0818	58.2668	59.1521	59.3207	60.1185	60.1185	60.2686	59.8087	59.3207	58.9806	58.6291	
alpha	4.8596	4.8721	4.8845	4.9435	4.9547	5.0079	5.0079	5.0179	4.9872	4.9547	4.9320	4.9086	
util living area	0.9983	0.9959	0.9889	0.9643	0.8920	0.7373	0.5682	0.6269	0.8636	0.9788	0.9963	0.9987	(86)
MIT	19.6753	19.8403	20.1039	20.4526	20.7534	20.9354	20.9859	20.9775	20.8491	20.4555	20.0041	19.6526	(87)
Th 2	19.9204	19.9235	19.9265	19.9409	19.9435	19.9561	19.9561	19.9584	19.9512	19.9435	19.9381	19.9324	(88)
util rest of house	0.9977	0.9944	0.9848	0.9503	0.8492	0.6453	0.4422	0.4994	0.7948	0.9679	0.9948	0.9983	(89)
MIT 2	18.7159	18.8828	19.1467	19.4983	19.7756	19.9261	19.9525	19.9520	19.8666	19.5082	19.0582	18.7028	(90)
Living area fraction	18.9570	19.1233	19.3872	19.7381	20.0212	20.1797	20.2121	20.2096	20.1134	19.7462	19.2959	18.9415	(91)
MIT	18.9570	19.1233	19.3872	19.7381	20.0212	20.1797	20.2121	20.2096	20.1134	19.7462	19.2959	18.9415	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9570	19.1233	19.3872	19.7381	20.0212	20.1797	20.2121	20.2096	20.1134	19.7462	19.2959	18.9415	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	414.4660	485.0951	544.8775	586.8238	564.5270	433.7889	294.5779	307.2073	428.1117	448.5052	407.3606	390.4687	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1258.1075	1216.9415	1099.1184	910.5219	697.0918	461.2235	298.5822	314.1234	499.6498	766.2006	1027.5707	1249.4968	(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	627.6693	491.8008	412.3552	233.0626	98.6282	0.0000	0.0000	0.0000	0.0000	236.3653	446.5512	639.1169	(98)
Space heating												3185.5496	(98)
Space heating per m2												44.5158	(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	777.0118	611.6901	626.6577	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8667	0.9262	0.9030	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	673.4708	566.5608	565.8726	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	845.6493	809.4759	760.0750	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	123.9686	180.7288	144.4866	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												449.1840 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	30.9921	45.1822	36.1217	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												112.2960 (107)
Space cooling per m2												1.5693 (108)
Energy for space heating												44.5158 (99)
Energy for space cooling												1.5693 (108)
Total												46.0850 (109)
Target Fabric Energy Efficiency (TFEE)												53.0 (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	36.4000 (1b)	x 2.3100 (2b)	= 84.0840 (1b) - (3b)
First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																0 * 10 =	0.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour		
Pressure test															0.0000 / (5) =		0.0000 (8)
Measured/design AP50															Yes		
Infiltration rate															4.0100		
Number of sides sheltered															0.2005 (18)		
															1 (19)		
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.1855 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)					
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)					
Adj infilt rate																	
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)					
Mechanical extract ventilation - decentralised																	
If mechanical ventilation:															0.5000 (23a)		
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)					

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000 (28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360 (29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500 (30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500 (30)
Total net area of external elements Aum(A, m ²)			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2113		(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			55.3000			9.0000	497.7000 (32c)
Timber FF			93.9900			9.0000	845.9100 (32c)
Internal Floor			35.1600			12.6000	443.0160 (32d)
Internal Ceiling			35.1600			9.0000	316.4400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10525.6020 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.0878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3394 (36)
Total fabric heat loss						(33) + (36) =	46.5507 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.0155	Feb 29.0155	Mar 29.0155	Apr 29.0155	May 29.0155	Jun 29.0155	Jul 29.0155	Aug 29.0155	Sep 29.0155	Oct 29.0155	Nov 29.0155	Dec 29.0155 (38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662 (39)
Average = Sum(39)m / 12 =												75.5662 (39)
HLP	Jan 1.0560	Feb 1.0560	Mar 1.0560	Apr 1.0560	May 1.0560	Jun 1.0560	Jul 1.0560	Aug 1.0560	Sep 1.0560	Oct 1.0560	Nov 1.0560	Dec 1.0560 (40)
HLP (average)												1.0560 (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	2.2834 (42)
Average daily hot water use (litres/day)	88.4306 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF HEAT DEMAND 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy content (annual)	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Distribution loss (46)m = 0.15 x (45)m	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(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	14.6379	13.1959	14.5692	14.0534	14.4885	13.9827	14.4248	14.4661	14.0212	14.5358	14.1201	14.6246	(61)
Total heat required for water heating calculated for each month	158.8919	139.3614	144.7607	127.5575	123.3984	107.9637	101.5120	114.3999	115.1486	132.3900	142.7671	154.3269	(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	158.8919	139.3614	144.7607	127.5575	123.3984	107.9637	101.5120	114.3999	115.1486	132.3900	142.7671	154.3269	(64)
RHI water heating demand	51.6239	45.2490	46.9310	41.2535	39.8347	34.7443	32.5627	36.8445	37.1301	42.8205	46.3052	50.1072	(65)
Heat gains from water heating, kWh/month	51.6239	45.2490	46.9310	41.2535	39.8347	34.7443	32.5627	36.8445	37.1301	42.8205	46.3052	50.1072	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)	69.3870	67.3348	63.0793	57.2965	53.5412	48.2560	43.7671	49.5222	51.5696	57.5544	64.3127	67.3484	(72)
Total internal gains	515.2826	511.1566	491.3672	460.7529	429.5219	401.4790	385.0481	392.8770	410.4583	441.2746	475.5086	501.3020	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
Northeast				3.9400	12.9236		0.4600	0.0000	0.7700		18.0354 (75)	
Southwest				4.1400	40.4699		0.4600	0.0000	0.7700		59.3446 (79)	
Northwest				0.6600	12.9236		0.4600	0.0000	0.7700		3.0212 (81)	
Southwest				3.1500	40.4699		0.4300	0.0000	0.7700		42.2087 (79)	
Solar gains	122.6099	194.3856	279.9164	387.3747	449.2976	489.7632	461.9781	412.4864	339.1231	234.3692	151.7827	103.0884 (83)
Total gains	637.8925	705.5422	771.2836	848.1276	878.8196	891.2422	847.0262	805.3635	749.5813	675.6437	627.2913	604.3904 (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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area	0.9485	0.9270	0.8779	0.7773	0.6193	0.4124	0.2745	0.2974	0.5458	0.8008	0.9168	0.9556	(86)
MIT	19.8094	19.9825	20.3001	20.6416	20.8796	20.9795	20.9966	20.9954	20.9418	20.6621	20.1870	19.7545	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house	0.9391	0.9141	0.8565	0.7402	0.5611	0.3374	0.1902	0.2093	0.4678	0.7584	0.8996	0.9473	(89)
MIT 2	18.4884	18.7329	19.1764	19.6329	19.9240	20.0242	20.0359	20.0355	19.9934	19.6711	19.0275	18.4108	(90)
Living area fraction	18.8203	19.0469	19.4588	19.8863	20.1641	20.2642	20.2773	20.2767	20.2317	19.9201	19.3188	18.7484	(91)
MIT	18.8203	19.0469	19.4588	19.8863	20.1641	20.2642	20.2773	20.2767	20.2317	19.9201	19.3188	18.7484	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6703	18.8969	19.3088	19.7363	20.0141	20.1142	20.1273	20.1267	20.0817	19.7701	19.1688	18.5984	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9220	0.8952	0.8375	0.7274	0.5596	0.3436	0.1982	0.2176	0.4716	0.7451	0.8805	0.9311	(94)
Useful gains	588.1607	631.6319	645.9793	616.9580	491.8280	306.1903	167.8937	175.2253	353.4869	503.4316	552.3529	562.7726	(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	1025.4553	1004.7952	899.9010	743.2928	530.0265	310.8963	168.3088	175.8179	368.8936	617.3814	843.9842	1020.0256	(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	325.3472	250.7657	188.9177	90.9610	28.4197	0.0000	0.0000	0.0000	0.0000	84.7787	209.9745	340.1962	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating
RHI space heating demand

1519.3608 (98)
1519 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.4000 (1b)	x 2.3100 (2b)	= 84.0840 (1b) - (3b)
First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000 (28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360 (29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500 (30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500 (30)
Total net area of external elements Aum(A, m ²)			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2113		(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			55.3000			9.0000	497.7000 (32c)
Timber FF			93.9900			9.0000	845.9100 (32c)
Internal Floor			35.1600			12.6000	443.0160 (32d)
Internal Ceiling			35.1600			9.0000	316.4400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	10525.6020 (34)
Thermal mass parameter (TMP) = Cm / TFA in kJ/m ² K							147.0878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3394 (36)
Total fabric heat loss						(33) + (36) =	46.5507 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.0155	Feb 29.0155	Mar 29.0155	Apr 29.0155	May 29.0155	Jun 29.0155	Jul 29.0155	Aug 29.0155	Sep 29.0155	Oct 29.0155	Nov 29.0155	Dec 29.0155 (38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662 (39)
Average = Sum(39)m / 12 =												75.5662 (39)
HLP	Jan 1.0560	Feb 1.0560	Mar 1.0560	Apr 1.0560	May 1.0560	Jun 1.0560	Jul 1.0560	Aug 1.0560	Sep 1.0560	Oct 1.0560	Nov 1.0560	Dec 1.0560 (40)
HLP (average)												1.0560 (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	2.2834 (42)
Average daily hot water use (litres/day)	88.4306 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total =	Sum (45)m =	1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(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	14.6379	13.1959	14.5692	14.0534	14.4885	13.9827	14.4248	14.4661	14.0212	14.5358	14.1201	14.6246	(61)
Total heat required for water heating calculated for each month	158.8919	139.3614	144.7607	127.5575	123.3984	107.9637	101.5120	114.3999	115.1486	132.3900	142.7671	154.3269	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq. (G10)
Total of WWHRS savings												-417.7106	
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	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178	(64)
Heat gains from water heating, kWh/month	51.6239	45.2490	46.9310	41.2535	39.8347	34.7443	32.5627	36.8445	37.1301	42.8205	46.3052	50.1072	(65)
										Total per year (kWh/year) =	Sum (64)m =	1144.7675	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)	69.3870	67.3348	63.0793	57.2965	53.5412	48.2560	43.7671	49.5222	51.5696	57.5544	64.3127	67.3484	(72)
Total internal gains	515.2826	511.1566	491.3672	460.7529	429.5219	401.4790	385.0481	392.8770	410.4583	441.2746	475.5086	501.3020	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.9400	11.2829	0.4600	0.0000	0.7700	15.7459 (75)			
Southwest				4.1400	36.7938	0.4600	0.0000	0.7700	53.9540 (79)			
Northwest				0.6600	11.2829	0.4600	0.0000	0.7700	2.6376 (81)			
Southwest				3.1500	36.7938	0.4300	0.0000	0.7700	38.3747 (79)			
Solar gains	110.7122	194.6902	282.6029	377.3448	447.4718	455.1508	434.2717	380.2851	315.1498	219.5472	133.7197	94.0270 (83)
Total gains	625.9948	705.8467	773.9701	838.0977	876.9937	856.6298	819.3198	773.1621	725.6081	660.8218	609.2283	595.3290 (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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area													
	0.9573	0.9348	0.8938	0.8143	0.6883	0.5303	0.3961	0.4351	0.6391	0.8438	0.9349	0.9636	(86)
MIT	19.6771	19.8885	20.1936	20.5371	20.8021	20.9414	20.9841	20.9776	20.8849	20.5443	20.0402	19.6109	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house													
	0.9497	0.9236	0.8756	0.7832	0.6390	0.4610	0.3134	0.3498	0.5708	0.8104	0.9217	0.9570	(89)
MIT 2	18.2983	18.5987	19.0276	19.4956	19.8334	19.9903	20.0284	20.0241	19.9362	19.5177	18.8204	18.2037	(90)
Living area fraction													
	18.6447	18.9228	19.3206	19.7573	20.0768	20.2293	20.2685	20.2636	20.1746	19.7756	19.1269	18.5572	(91)
Temperature adjustment													
	adjusted MIT	18.4947	18.7728	19.1706	19.6073	19.9268	20.0793	20.1185	20.1136	20.0246	19.6256	18.9769	18.4072 (93)
													-0.1500

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9338	0.9052	0.8563	0.7677	0.6329	0.4642	0.3206	0.3568	0.5699	0.7938	0.9033	0.9421 (94)
Useful gains	584.5528	638.9418	662.7160	643.3860	555.0808	397.6066	262.6664	275.8276	413.5085	524.5660	550.3404	560.8810 (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	1072.6419	1048.3135	957.4678	809.1123	621.6696	414.0467	265.8825	280.6254	447.6998	682.0324	897.4918	1073.5873 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating	363.1383	275.0978	219.2954	119.3230	49.5421	0.0000	0.0000	0.0000	0.0000	117.1550	249.9490	381.4535 (98)
Space heating per m2												1774.9540 (98)
											(98) / (4) =	24.8037 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1961.2751 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	363.1383	275.0978	219.2954	119.3230	49.5421	0.0000	0.0000	0.0000	0.0000	117.1550	249.9490	381.4535 (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)	401.2578	303.9754	242.3153	131.8486	54.7426	0.0000	0.0000	0.0000	0.0000	129.4531	276.1868	421.4955 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178 (64)
Efficiency of water heater (217)m	89.7225	89.6339	89.4519	89.0682	88.3980	87.3000	87.3000	87.3000	87.3000	89.0133	89.5420	87.3000 (216)
Fuel for water heating, kWh/month	125.3013	109.8671	115.1819	104.6427	103.4965	93.5076	90.7361	100.1206	100.0834	110.1733	115.0652	89.7665 (217)
Water heating fuel used												121.8915 (219)
Annual totals kWh/year												1290.0673 (219)
Space heating fuel - main system												1961.2751 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												49.2222 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												124.2222 (231)
Electricity for lighting (calculated in Appendix L)												327.6189 (232)
Total delivered energy for all uses												3703.1835 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1961.2751	3.4800	68.2524 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1290.0673	3.4800	44.8943 (247)
Mechanical ventilation fans	49.2222	13.1900	6.4924 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	327.6189	13.1900	43.2129 (250)
Additional standing charges			120.0000 (251)
Total energy cost			292.7446 (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] =	1.0548 (257)
SAP value		85.2849
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	1961.2751	0.2160	423.6354 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1290.0673	0.2160	278.6545 (264)
Space and water heating			702.2900 (265)
Pumps and fans	124.2222	0.5190	64.4713 (267)
Energy for lighting	327.6189	0.5190	170.0342 (268)
Total kg/year			936.7955 (272)
CO2 emissions per m2			13.0900 (273)
EI value			89.2304
EI rating			89 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8865 = 3.926$, stars = 5
Water heating environmental impact	$0.216 / 0.8865 = 0.2437$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.4000 (1b)	x 2.3100 (2b)	= 84.0840 (1b) - (3b)
First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000 (28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360 (29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500 (30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500 (30)
Total net area of external elements Aum(A, m ²)			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			55.3000			9.0000	497.7000 (32c)
Timber FF			93.9900			9.0000	845.9100 (32c)
Internal Floor			35.1600			12.6000	443.0160 (32d)
Internal Ceiling			35.1600			9.0000	316.4400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	10525.6020			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.0878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3394 (36)
Total fabric heat loss			(33) + (36) =	46.5507			(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.0155	Feb 29.0155	Mar 29.0155	Apr 29.0155	May 29.0155	Jun 29.0155	Jul 29.0155	Aug 29.0155	Sep 29.0155	Oct 29.0155	Nov 29.0155	Dec 29.0155 (38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662 (39)
Average = Sum(39)m / 12 =												75.5662 (39)
HLP	Jan 1.0560	Feb 1.0560	Mar 1.0560	Apr 1.0560	May 1.0560	Jun 1.0560	Jul 1.0560	Aug 1.0560	Sep 1.0560	Oct 1.0560	Nov 1.0560	Dec 1.0560 (40)
HLP (average)												1.0560 (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	2.2834 (42)
Average daily hot water use (litres/day)	88.4306 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)	Total = Sum (45)m = 1391.3579												(45)
Distribution loss (46)m = 0.15 x (45)m	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(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	14.6379	13.1959	14.5692	14.0534	14.4885	13.9827	14.4248	14.4661	14.0212	14.5358	14.1201	14.6246	(61)
Total heat required for water heating calculated for each month	158.8919	139.3614	144.7607	127.5575	123.3984	107.9637	101.5120	114.3999	115.1486	132.3900	142.7671	154.3269	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq. (G10)
Total of WWHRS savings	-417.7106												
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	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178	(64)
Heat gains from water heating, kWh/month	51.6239	45.2490	46.9310	41.2535	39.8347	34.7443	32.5627	36.8445	37.1301	42.8205	46.3052	50.1072	(65)
Total per year (kWh/year) = Sum (64)m = 1144.7675													(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)	69.3870	67.3348	63.0793	57.2965	53.5412	48.2560	43.7671	49.5222	51.5696	57.5544	64.3127	67.3484	(72)
Total internal gains	515.2826	511.1566	491.3672	460.7529	429.5219	401.4790	385.0481	392.8770	410.4583	441.2746	475.5086	501.3020	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast				3.9400	12.9236	0.4600	0.0000		0.7700		18.0354 (75)	
Southwest				4.1400	40.4699	0.4600	0.0000		0.7700		59.3446 (79)	
Northwest				0.6600	12.9236	0.4600	0.0000		0.7700		3.0212 (81)	
Southwest				3.1500	40.4699	0.4300	0.0000		0.7700		42.2087 (79)	
Solar gains	122.6099	194.3856	279.9164	387.3747	449.2976	489.7632	461.9781	412.4864	339.1231	234.3692	151.7827	103.0884 (83)
Total gains	637.8925	705.5422	771.2836	848.1276	878.8196	891.2422	847.0262	805.3635	749.5813	675.6437	627.2913	604.3904 (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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area	0.9485	0.9270	0.8779	0.7773	0.6193	0.4124	0.2745	0.2974	0.5458	0.8008	0.9168	0.9556	(86)
MIT	19.8094	19.9825	20.3001	20.6416	20.8796	20.9795	20.9966	20.9954	20.9418	20.6621	20.1870	19.7545	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house	0.9391	0.9141	0.8565	0.7402	0.5611	0.3374	0.1902	0.2093	0.4678	0.7584	0.8996	0.9473	(89)
MIT 2	18.4884	18.7329	19.1764	19.6329	19.9240	20.0242	20.0359	20.0355	19.9934	19.6711	19.0275	18.4108	(90)
Living area fraction	18.8203	19.0469	19.4588	19.8863	20.1641	20.2642	20.2773	20.2767	20.2317	19.9201	19.3188	18.7484	(92)
MIT	18.8203	19.0469	19.4588	19.8863	20.1641	20.2642	20.2773	20.2767	20.2317	19.9201	19.3188	18.7484	(91)
Temperature adjustment	18.8203	19.0469	19.4588	19.8863	20.1641	20.2642	20.2773	20.2767	20.2317	19.9201	19.3188	18.7484	(92)
adjusted MIT	18.6703	18.8969	19.3088	19.7363	20.0141	20.1142	20.1273	20.1267	20.0817	19.7701	19.1688	18.5984	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9220	0.8952	0.8375	0.7274	0.5596	0.3436	0.1982	0.2176	0.4716	0.7451	0.8805	0.9311	(94)
Useful gains	588.1607	631.6319	645.9793	616.9580	491.8280	306.1903	167.8937	175.2253	353.4869	503.4316	552.3529	562.7726	(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	1025.4553	1004.7952	899.9010	743.2928	530.0265	310.8963	168.3088	175.8179	368.8936	617.3814	843.9842	1020.0256	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Space heating	325.3472	250.7657	188.9177	90.9610	28.4197	0.0000	0.0000	0.0000	0.0000	84.7787	209.9745	340.1962 (98)
Space heating per m2												1519.3608 (98)
											(98) / (4) =	21.2320 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1678.8517 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	325.3472	250.7657	188.9177	90.9610	28.4197	0.0000	0.0000	0.0000	0.0000	84.7787	209.9745	340.1962 (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)	359.4997	277.0892	208.7488	100.5094	31.4030	0.0000	0.0000	0.0000	0.0000	93.6781	232.0161	375.9074 (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	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178 (64)
Efficiency of water heater (217)m	89.6560	89.5742	89.3442	88.8517	88.0378	87.3000	87.3000	87.3000	87.3000	88.7551	89.4211	87.3000 (216)
Fuel for water heating, kWh/month	125.3942	109.9404	115.3207	104.8977	103.9200	93.5076	90.7361	100.1206	100.0834	110.4938	115.2208	121.9821 (219)
Water heating fuel used												1291.6173 (219)
Annual totals kWh/year												
Space heating fuel - main system												1678.8517 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												49.2222 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												124.2222 (231)
Electricity for lighting (calculated in Appendix L)												327.6189 (232)
Total delivered energy for all uses												3422.3101 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1678.8517	3.9200	65.8110 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1291.6173	3.9200	50.6314 (247)
Mechanical ventilation fans	49.2222	16.9600	8.3481 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	327.6189	16.9600	55.5642 (250)
Additional standing charges			88.0000 (251)
Total energy cost			281.0746 (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	1678.8517	0.2160	362.6320 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.6173	0.2160	278.9893 (264)
Space and water heating			641.6213 (265)
Pumps and fans	124.2222	0.5190	64.4713 (267)
Energy for lighting	327.6189	0.5190	170.0342 (268)
Total kg/year			876.1268 (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	1678.8517	1.2200	2048.1991 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.6173	1.2200	1575.7731 (264)
Space and water heating			3623.9722 (265)
Pumps and fans	124.2222	3.0700	381.3621 (267)
Energy for lighting	327.6189	3.0700	1005.7900 (268)
Primary energy kWh/year			5011.1243 (272)
Primary energy kWh/m2/year			70.0269 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 89

(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	+ 11.5	-£ 309	-947 kg (108.1%)
Measures omitted - SAP change or cost saving too small:			
N Solar water heating	+ 0.9	-£ 20	-130 kg (14.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 13.23 kg/m ²	A 97	A 100
Total Savings	£309 13.23 kg/m ²		
Potential energy efficiency rating:		A 97	
Potential environmental impact rating:			A 100

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	£77	£77	£0
Mains gas	£204	£204	£0
Space heating	£175	£175	£0
Water heating	£51	£51	£0
Lighting	£56	£56	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£281	-£28	£309
Total cost of uses	£282	-£27	£309
Delivered energy	48 kWh/m ²	22 kWh/m ²	25 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	-0.1 tonnes	0.9 tonnes
CO2 emissions per m ²	12 kg/m ²	-1 kg/m ²	13 kg/m ²
Primary energy	70 kWh/m ²	-8 kWh/m ²	78 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.4000 (1b)	x 2.3100 (2b)	= 84.0840 (1b) - (3b)
First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.2365	0.2318	0.2272	0.2040	0.1994	0.1762	0.1762	0.1716	0.1855	0.1994	0.2086	0.2179 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000 (28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360 (29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500 (30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500 (30)
Total net area of external elements Aum(A, m ²)			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	41.2113			(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			55.3000			9.0000	497.7000 (32c)
Timber FF			93.9900			9.0000	845.9100 (32c)
Internal Floor			35.1600			12.6000	443.0160 (32d)
Internal Ceiling			35.1600			9.0000	316.4400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	10525.6020			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.0878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3394 (36)
Total fabric heat loss			(33) + (36) =	46.5507			(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.0155	Feb 29.0155	Mar 29.0155	Apr 29.0155	May 29.0155	Jun 29.0155	Jul 29.0155	Aug 29.0155	Sep 29.0155	Oct 29.0155	Nov 29.0155	Dec 29.0155 (38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662 (39)
Average = Sum(39)m / 12 =												75.5662 (39)
HLP	Jan 1.0560	Feb 1.0560	Mar 1.0560	Apr 1.0560	May 1.0560	Jun 1.0560	Jul 1.0560	Aug 1.0560	Sep 1.0560	Oct 1.0560	Nov 1.0560	Dec 1.0560 (40)
HLP (average)												1.0560 (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	2.2834 (42)
Average daily hot water use (litres/day)	88.4306 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy conte	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Energy content (annual)										Total =	Sum (45)m =	1391.3579	(45)
Distribution loss (46)m = 0.15 x (45)m	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(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	14.6379	13.1959	14.5692	14.0534	14.4885	13.9827	14.4248	14.4661	14.0212	14.5358	14.1201	14.6246	(61)
Total heat required for water heating calculated for each month	158.8919	139.3614	144.7607	127.5575	123.3984	107.9637	101.5120	114.3999	115.1486	132.3900	142.7671	154.3269	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq. (G10)
Total of WWHRS savings												-417.7106	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) =										Sum (63)m =		0.0000	(63)
Output from w/h	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178	(64)
Heat gains from water heating, kWh/month	51.6239	45.2490	46.9310	41.2535	39.8347	34.7443	32.5627	36.8445	37.1301	42.8205	46.3052	50.1072	(65)
										Total per year (kWh/year) =	Sum (64)m =	1144.7675	(64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)	69.3870	67.3348	63.0793	57.2965	53.5412	48.2560	43.7671	49.5222	51.5696	57.5544	64.3127	67.3484	(72)
Total internal gains	515.2826	511.1566	491.3672	460.7529	429.5219	401.4790	385.0481	392.8770	410.4583	441.2746	475.5086	501.3020	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.9400	11.2829	0.4600	0.0000	0.7700	15.7459 (75)			
Southwest				4.1400	36.7938	0.4600	0.0000	0.7700	53.9540 (79)			
Northwest				0.6600	11.2829	0.4600	0.0000	0.7700	2.6376 (81)			
Southwest				3.1500	36.7938	0.4300	0.0000	0.7700	38.3747 (79)			
Solar gains	110.7122	194.6902	282.6029	377.3448	447.4718	455.1508	434.2717	380.2851	315.1498	219.5472	133.7197	94.0270 (83)
Total gains	625.9948	705.8467	773.9701	838.0977	876.9937	856.6298	819.3198	773.1621	725.6081	660.8218	609.2283	595.3290 (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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
alpha	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area	0.9573	0.9348	0.8938	0.8143	0.6883	0.5303	0.3961	0.4351	0.6391	0.8438	0.9349	0.9636 (86)	
MIT	19.6771	19.8885	20.1936	20.5371	20.8021	20.9414	20.9841	20.9776	20.8849	20.5443	20.0402	19.6109 (87)	
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369 (88)	
util rest of house	0.9497	0.9236	0.8756	0.7832	0.6390	0.4610	0.3134	0.3498	0.5708	0.8104	0.9217	0.9570 (89)	
MIT 2	18.2983	18.5987	19.0276	19.4956	19.8334	19.9903	20.0284	20.0241	19.9362	19.5177	18.8204	18.2037 (90)	
Living area fraction									fLA = Living area / (4) =				0.2513 (91)
MIT	18.6447	18.9228	19.3206	19.7573	20.0768	20.2293	20.2685	20.2636	20.1746	19.7756	19.1269	18.5572 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.4947	18.7728	19.1706	19.6073	19.9268	20.0793	20.1185	20.1136	20.0246	19.6256	18.9769	18.4072 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9338	0.9052	0.8563	0.7677	0.6329	0.4642	0.3206	0.3568	0.5699	0.7938	0.9033	0.9421	(94)
Useful gains	584.5528	638.9418	662.7160	643.3860	555.0808	397.6066	262.6664	275.8276	413.5085	524.5660	550.3404	560.8810	(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	1072.6419	1048.3135	957.4678	809.1123	621.6696	414.0467	265.8825	280.6254	447.6998	682.0324	897.4918	1073.5873	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating	363.1383	275.0978	219.2954	119.3230	49.5421	0.0000	0.0000	0.0000	0.0000	117.1550	249.9490	381.4535 (98)
Space heating per m2												1774.9540 (98)
												(98) / (4) = 24.8037 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1961.2751 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	363.1383	275.0978	219.2954	119.3230	49.5421	0.0000	0.0000	0.0000	0.0000	117.1550	249.9490	381.4535 (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)	401.2578	303.9754	242.3153	131.8486	54.7426	0.0000	0.0000	0.0000	0.0000	129.4531	276.1868	421.4955 (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	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178 (64)
Efficiency of water heater (217)m	89.7225	89.6339	89.4519	89.0682	88.3980	87.3000	87.3000	87.3000	87.3000	89.0133	89.5420	87.3000 (216)
Fuel for water heating, kWh/month	125.3013	109.8671	115.1819	104.6427	103.4965	93.5076	90.7361	100.1206	100.0834	110.1733	115.0652	121.8915 (219)
Water heating fuel used												1290.0673 (219)
Annual totals kWh/year												1961.2751 (211)
Space heating fuel - main system												0.0000 (215)
Space heating fuel - secondary												
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												49.2222 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												124.2222 (231)
Electricity for lighting (calculated in Appendix L)												327.6189 (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												1975.9441 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1961.2751	3.4800	68.2524 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1290.0673	3.4800	44.8943 (247)
Mechanical ventilation fans	49.2222	13.1900	6.4924 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	327.6189	13.1900	43.2129 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			64.9217 (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] =	0.2339 (257)
SAP value		96.7366
SAP rating (Section 12)		97 (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	1961.2751	0.2160	423.6354 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1290.0673	0.2160	278.6545 (264)
Space and water heating			702.2900 (265)
Pumps and fans	124.2222	0.5190	64.4713 (267)
Energy for lighting	327.6189	0.5190	170.0342 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Total kg/year	40.3582 (272)
CO2 emissions per m2	0.5600 (273)
EI value	99.5360
EI rating	100 (274)
EI band	A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.4000 (1b)	x 2.3100 (2b)	= 84.0840 (1b) - (3b)
First floor	35.1600 (1c)	x 2.6100 (2c)	= 91.7676 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.5600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 175.8516 (5)

2. Ventilation rate

					main heating	secondary heating	other		total	m3 per hour		
Number of chimneys					0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues					0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans											0 * 10 =	0.0000 (7a)
Number of passive vents											0 * 10 =	0.0000 (7b)
Number of flueless gas fires											0 * 40 =	0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =											0.0000 / (5) =	0.0000 (8)
Pressure test											Yes	
Measured/design AP50												4.0100
Infiltration rate												0.2005 (18)
Number of sides sheltered												1 (19)
Shelter factor											(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =	0.1855 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.1947	0.1855	0.1855	0.1716	0.1716	0.1530	0.1576	0.1484	0.1530	0.1623	0.1623	0.1762 (22b)
Mechanical extract ventilation - decentralised												
If mechanical ventilation:												0.5000 (23a)
Effective ac	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000	0.5000 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			1.9800	1.0000	1.9800		(26)
Window (Uw = 1.20)			8.7400	1.1450	10.0076		(27)
French Door (Uw = 1.40)			3.1500	1.3258	4.1761		(27)
FP McCann System			36.4000	0.1100	4.0040	75.0000	2730.0000 (28a)
100mm Knauf Supafil 34	84.4900	13.8700	70.6200	0.2500	17.6550	52.8000	3728.7360 (29a)
Plane Ceiling-500mm Loft Roll	35.1500		35.1500	0.0900	3.1635	9.0000	316.3500 (30)
Porch Roof - 200mm	1.2500		1.2500	0.1800	0.2250	9.0000	11.2500 (30)
Total net area of external elements Aum(A, m ²)			157.2900				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		41.2113		(33)
E-WM-30			36.3600	0.0000	0.0000	45.0000	1636.2000 (32)
Timber GF			55.3000			9.0000	497.7000 (32c)
Timber FF			93.9900			9.0000	845.9100 (32c)
Internal Floor			35.1600			12.6000	443.0160 (32d)
Internal Ceiling			35.1600			9.0000	316.4400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		10525.6020 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							147.0878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.3394 (36)
Total fabric heat loss						(33) + (36) =	46.5507 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 29.0155	Feb 29.0155	Mar 29.0155	Apr 29.0155	May 29.0155	Jun 29.0155	Jul 29.0155	Aug 29.0155	Sep 29.0155	Oct 29.0155	Nov 29.0155	Dec 29.0155 (38)
Heat transfer coeff	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662	75.5662 (39)
Average = Sum(39)m / 12 =												75.5662 (39)
HLP	Jan 1.0560	Feb 1.0560	Mar 1.0560	Apr 1.0560	May 1.0560	Jun 1.0560	Jul 1.0560	Aug 1.0560	Sep 1.0560	Oct 1.0560	Nov 1.0560	Dec 1.0560 (40)
HLP (average)												1.0560 (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	2.2834 (42)
Average daily hot water use (litres/day)	88.4306 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.2737	93.7365	90.1992	86.6620	83.1248	79.5876	79.5876	83.1248	86.6620	90.1992	93.7365	97.2737	(44)
Energy content (annual)	144.2541	126.1655	130.1915	113.5041	108.9099	93.9810	87.0872	99.9338	101.1273	117.8542	128.6470	139.7023	(45)
Distribution loss (46)m = 0.15 x (45)m													1391.3579 (45)
Water storage loss:	21.6381	18.9248	19.5287	17.0256	16.3365	14.0971	13.0631	14.9901	15.1691	17.6781	19.2971	20.9554	(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	14.6379	13.1959	14.5692	14.0534	14.4885	13.9827	14.4248	14.4661	14.0212	14.5358	14.1201	14.6246	(61)
Total heat required for water heating calculated for each month	158.8919	139.3614	144.7607	127.5575	123.3984	107.9637	101.5120	114.3999	115.1486	132.3900	142.7671	154.3269	(62)
WWHRS	-46.4685	-40.8832	-41.7283	-34.3541	-31.9095	-26.3316	-22.2994	-26.9946	-27.7758	-34.3211	-39.7354	-44.9091	eq. (G10)
Total of WWHRS savings												-417.7106	
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	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178	(64)
Heat gains from water heating, kWh/month	51.6239	45.2490	46.9310	41.2535	39.8347	34.7443	32.5627	36.8445	37.1301	42.8205	46.3052	50.1072	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	137.0037	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	46.3778	41.1924	33.4999	25.3616	18.9581	16.0052	17.2942	22.4796	30.1721	38.3105	44.7140	47.6668	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	299.8661	302.9777	295.1364	278.4432	257.3710	237.5661	224.3352	221.2235	229.0649	245.7581	266.8303	286.6352	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	50.9838	(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)	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	-91.3358	(71)
Water heating gains (Table 5)	69.3870	67.3348	63.0793	57.2965	53.5412	48.2560	43.7671	49.5222	51.5696	57.5544	64.3127	67.3484	(72)
Total internal gains	515.2826	511.1566	491.3672	460.7529	429.5219	401.4790	385.0481	392.8770	410.4583	441.2746	475.5086	501.3020	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				3.9400	12.9236	0.4600	0.0000	0.7700	18.0354 (75)			
Southwest				4.1400	40.4699	0.4600	0.0000	0.7700	59.3446 (79)			
Northwest				0.6600	12.9236	0.4600	0.0000	0.7700	3.0212 (81)			
Southwest				3.1500	40.4699	0.4300	0.0000	0.7700	42.2087 (79)			
Solar gains	122.6099	194.3856	279.9164	387.3747	449.2976	489.7632	461.9781	412.4864	339.1231	234.3692	151.7827	103.0884 (83)
Total gains	637.8925	705.5422	771.2836	848.1276	878.8196	891.2422	847.0262	805.3635	749.5813	675.6437	627.2913	604.3904 (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	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	38.6916	
Feb	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	3.5794	
util living area	0.9485	0.9270	0.8779	0.7773	0.6193	0.4124	0.2745	0.2974	0.5458	0.8008	0.9168	0.9556	(86)
MIT	19.8094	19.9825	20.3001	20.6416	20.8796	20.9795	20.9966	20.9954	20.9418	20.6621	20.1870	19.7545	(87)
Th 2	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	20.0369	(88)
util rest of house	0.9391	0.9141	0.8565	0.7402	0.5611	0.3374	0.1902	0.2093	0.4678	0.7584	0.8996	0.9473	(89)
MIT 2	18.4884	18.7329	19.1764	19.6329	19.9240	20.0242	20.0359	20.0355	19.9934	19.6711	19.0275	18.4108	(90)
Living area fraction									fLA = Living area / (4) =			0.2513	(91)
MIT	18.8203	19.0469	19.4588	19.8863	20.1641	20.2642	20.2773	20.2767	20.2317	19.9201	19.3188	18.7484	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6703	18.8969	19.3088	19.7363	20.0141	20.1142	20.1273	20.1267	20.0817	19.7701	19.1688	18.5984	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9220	0.8952	0.8375	0.7274	0.5596	0.3436	0.1982	0.2176	0.4716	0.7451	0.8805	0.9311	(94)
Useful gains	588.1607	631.6319	645.9793	616.9580	491.8280	306.1903	167.8937	175.2253	353.4869	503.4316	552.3529	562.7726	(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	1025.4553	1004.7952	899.9010	743.2928	530.0265	310.8963	168.3088	175.8179	368.8936	617.3814	843.9842	1020.0256	(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													

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Space heating	325.3472	250.7657	188.9177	90.9610	28.4197	0.0000	0.0000	0.0000	0.0000	84.7787	209.9745	340.1962 (98)
Space heating per m2											(98) / (4) =	21.2320 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												1678.8517 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	325.3472	250.7657	188.9177	90.9610	28.4197	0.0000	0.0000	0.0000	0.0000	84.7787	209.9745	340.1962 (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)	359.4997	277.0892	208.7488	100.5094	31.4030	0.0000	0.0000	0.0000	0.0000	93.6781	232.0161	375.9074 (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	112.4234	98.4782	103.0324	93.2034	91.4889	81.6321	79.2126	87.4053	87.3728	98.0689	103.0317	109.4178 (64)
Efficiency of water heater	89.6560	89.5742	89.3442	88.8517	88.0378	87.3000	87.3000	87.3000	87.3000	88.7551	89.4211	87.3000 (216)
Fuel for water heating, kWh/month	125.3942	109.9404	115.3207	104.8977	103.9200	93.5076	90.7361	100.1206	100.0834	110.4938	115.2208	121.9821 (219)
Water heating fuel used												1291.6173 (219)
Annual totals kWh/year												
Space heating fuel - main system												1678.8517 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
(MEV)Decentralised, Database: total watage = 8.4890, total flow = 37.0000, SFP = 0.2294)												
mechanical ventilation fans (SFP = 0.2294)												49.2222 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												124.2222 (231)
Electricity for lighting (calculated in Appendix L)												327.6189 (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												1598.1505 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1678.8517	3.9200	65.8110 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1291.6173	3.9200	50.6314 (247)
Mechanical ventilation fans	49.2222	16.9600	8.3481 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	327.6189	16.9600	55.5642 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			-28.3028 (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	1678.8517	0.2160	362.6320 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1291.6173	0.2160	278.9893 (264)
Space and water heating			641.6213 (265)
Pumps and fans	124.2222	0.5190	64.4713 (267)
Energy for lighting	327.6189	0.5190	170.0342 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			-70.6120 (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	1678.8517	1.2200	2048.1991 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)

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Water heating (other fuel)	1291.6173	1.2200	1575.7731 (264)
Space and water heating			3623.9722 (265)
Pumps and fans	124.2222	3.0700	381.3621 (267)
Energy for lighting	327.6189	3.0700	1005.7900 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-589.0458 (272)
Primary energy kWh/m2/year			-8.2315 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North East
Overshading	Average or unknown
Thermal mass parameter	147.1 (calculated from construction elements)
Night ventilation	No
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	232.12 (P1)
Transmission heat loss coefficient	46.55 (37)
Summer heat loss coefficient	278.67 (P2)

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

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
North East	1.000	0.90	1.000	0.900 (P8)
South West	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	FF Specific data or Table 6c	Shading	Gains W
North East	3.9400	98.8453	0.4600	0.0000	0.9000	161.2325
South West	4.1400	119.9223	0.4600	0.0000	0.9000	205.5421
North West	0.6600	98.8453	0.4600	0.0000	0.9000	27.0085
South West	3.1500	119.9223	0.4300	0.0000	0.9000	146.1913
total:						539.9744

	Jun	Jul	Aug	
Solar gains	572	540	482	(P3/P4)
Internal gains	398	382	390	
Total summer gains	971	922	872	(P5)
Summer gain/loss ratio	3.48	3.31	3.13	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 147.1)	0.97	0.97	0.97	
Threshold temperature	20.45	22.18	21.90	(P7)
Likelihood of high internal temperature	Not significant	Medium	Slight	
Assessment of likelihood of high internal temperature:	Medium			