

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	X305 Semi			Issued on Date	15/12/2022
Assessment Reference	X305 Semi	Prop Type Ref	Hazel		
Property	3 Bed, K, WC, B, En				
SAP Rating	86 B	DER	13.46	TER	17.55
Environmental	89 B	% DER<TER	23.29		
CO ₂ Emissions (t/year)	0.97	DFEE	38.55	TFEE	50.05
General Requirements Compliance	Pass	% DFEE<TFEE	22.97		
Assessor Details	Mr. Christopher MacDougall, Chris MacDougall, Tel: 02032 902 902, chris.macdougall@aessc.co.uk			Assessor ID	Q920-0001
Client					

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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

DWELLING AS DESIGNED

Semi-Detached House, total floor area 87 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) 17.55 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 13.46 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)50.0 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE)38.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.11 (max. 0.25)	0.11 (max. 0.70)	OK
Roof	0.09 (max. 0.20)	0.09 (max. 0.35)	OK
Openings	1.21 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas

Data from database

Ideal LOGIC COMBI ESP1 35

Combi boiler

Efficiency: 89.6% SEDBUK2009

Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

Minimum 75% OK

8 Mechanical ventilation

Continuous extract system (decentralised)

Specific fan power: 0.1700 0.1800

Maximum 0.7 OK

9 Summertime temperature

Overheating risk (Thames Valley): Medium OK

Based on:

Overshading: Average

Windows facing East: 5.92 m², No overhang

Windows facing South: 1.54 m², No overhang

Windows facing West: 7.58 m², No overhang

Air change rate: 4.00 ach

Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K

Roof U-value 0.09 W/m²K

Floor U-value 0.11 W/m²K

Door U-value 1.00 W/m²K

Thermal bridging y-value 0.028 W/m²K

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.5236 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.9500	1.1450	13.6832			(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			43.2900	0.1100	4.7619	75.0000	3246.7500	(28a)					
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.2500	18.3525	52.8000	3876.0480	(29a)					
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.0900	3.8961	9.0000	389.6100	(30)					
Total net area of external elements Aum(A, m2)			177.1800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9403			(33)					
E-WM-30			40.3600	0.0000	0.0000	45.0000	1816.2000	(32)					
1F Timber			101.1200			9.0000	910.0800	(32c)					
GF Timber			57.3800			9.0000	516.4200	(32c)					
GF Masonry			19.2700			39.0000	751.5300	(32c)					
Internal Floor			43.2900			12.6000	545.4540	(32d)					
Internal Ceiling			43.2900			9.0000	389.6100	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12441.7020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.7018	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0482	(36)					
Total fabric heat loss						(33) + (36) =	51.9885	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.5714	Feb 34.5714	Mar 34.5714	Apr 34.5714	May 34.5714	Jun 34.5714	Jul 34.5714	Aug 34.5714	Sep 34.5714	Oct 34.5714	Nov 34.5714	Dec 34.5714	(38)
Heat transfer coeff	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	(39)
Average = Sum(39)m / 12 =												86.5599	(39)
HLP	Jan 0.9998	Feb 0.9998	Mar 0.9998	Apr 0.9998	May 0.9998	Jun 0.9998	Jul 0.9998	Aug 0.9998	Sep 0.9998	Oct 0.9998	Nov 0.9998	Dec 0.9998	(40)
HLP (average)												0.9998	(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	2.5760 (42)
Average daily hot water use (litres/day)	95.3790 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169	(44)
Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793	(45)
Energy content (annual)										Total =	Sum (45)m =	1500.6825	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3383	20.4118	21.0632	18.3634	17.6201	15.2048	14.0895	16.1679	16.3610	19.0672	20.8133	22.6019	(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	14.1300	12.7519	14.0844	13.5874	14.0093	13.5216	13.9501	13.9885	13.5575	14.0534	13.6458	14.1182	(61)
Total heat required for water heating calculated for each month	169.7186	148.8307	154.5056	136.0100	131.4767	114.8871	107.8800	121.7745	122.6308	141.1678	152.4012	164.7975	(62)
WWHRS	-47.8906	-42.1368	-43.0065	-35.3895	-32.8624	-27.1117	-22.9488	-27.7846	-28.5937	-35.3438	-40.9362	-46.2873	eq. (G10)
Total of WWHRS savings												-430.2918	
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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102	(64)
Heat gains from water heating, kWh/month	55.2657	48.4342	50.2111	44.1024	42.5602	37.0844	34.7192	39.3360	39.6562	45.7789	49.5476	53.6304	(65)
Total per year (kWh/year) =										Sum (64)m =		1235.7887	(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	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3092	18.9266	15.3922	11.6529	8.7107	7.3539	7.9461	10.3287	13.8632	17.6025	20.5447	21.9014	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.6433	235.0574	228.9739	216.0229	199.6746	184.3095	174.0446	171.6305	177.7140	190.6650	207.0133	222.3784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	(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)	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	(71)
Water heating gains (Table 5)	74.2819	72.0747	67.4881	61.2533	57.2046	51.5061	46.6656	52.8709	55.0781	61.5308	68.8161	72.0839	(72)
Total internal gains	392.8737	390.6980	376.4935	353.5684	330.2292	307.8089	293.2958	299.4695	311.2946	334.4376	361.0135	381.0031	(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			
East				5.9200	19.6403	0.4600	0.0000	0.7700	41.1830 (76)			
South				1.5400	46.7521	0.4600	0.0000	0.7700	25.5018 (78)			
West				4.4900	19.6403	0.4600	0.0000	0.7700	31.2351 (80)			
West				3.0900	19.6403	0.4300	0.0000	0.7700	20.0939 (80)			
Solar gains	118.0137	222.7383	351.2383	494.7982	595.3615	605.6165	578.0804	503.1702	402.2044	259.7875	145.5798	98.1132 (83)
Total gains	510.8874	613.4363	727.7319	848.3666	925.5907	913.4254	871.3761	802.6397	713.4991	594.2251	506.5933	479.1163 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)															
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec			
tau	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264			
alpha	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618			
util living area	0.9855	0.9716	0.9380	0.8596	0.7276	0.5641	0.4249	0.4761	0.7109	0.9132	0.9752	0.9884	(86)		
MIT	19.3946	19.6408	20.0244	20.4579	20.7759	20.9341	20.9820	20.9727	20.8466	20.3906	19.7914	19.3288	(87)		
Th 2	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	(88)		
util rest of house	0.9828	0.9663	0.9264	0.8340	0.6816	0.4958	0.3414	0.3890	0.6465	0.8913	0.9696	0.9862	(89)		
MIT 2	17.9266	18.2826	18.8314	19.4334	19.8469	20.0292	20.0733	20.0670	19.9421	19.3566	18.5043	17.8311	(90)		
Living area fraction									fLA = Living area / (4) =					0.1624	(91)
MIT	18.1650	18.5031	19.0251	19.5997	19.9978	20.1761	20.2209	20.2141	20.0890	19.5245	18.7134	18.0743	(92)		
Temperature adjustment													-0.1500		
adjusted MIT	18.0150	18.3531	18.8751	19.4497	19.8478	20.0261	20.0709	20.0641	19.9390	19.3745	18.5634	17.9243	(93)		

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9735	0.9735	0.9523	0.9068	0.8134	0.6687	0.4913	0.3402	0.3871	0.6353	0.8700	0.9564	0.9782	(94)
Useful gains	497.3461	584.1976	659.8948	690.0744	618.9139	448.7674	296.4249	310.6728	453.2647	516.9739	484.4833	468.6821	(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	1187.1663	1164.5006	1071.1892	913.1844	705.2717	469.6847	300.4411	317.1610	505.4222	759.5201	992.2668	1187.9778	(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 DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

513.2262	389.9636	306.0030	160.6393	64.2502	0.0000	0.0000	0.0000	0.0000	180.4544	365.6041	535.1560 (98)
Space heating											2515.2969 (98)
Space heating per m2											(98) / (4) = 29.0517 (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		2779.3336 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	513.2262	389.9636	306.0030	160.6393	64.2502	0.0000	0.0000	0.0000	0.0000	180.4544	365.6041	535.1560 (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)	567.1008	430.8991	338.1249	177.5019	70.9947	0.0000	0.0000	0.0000	0.0000	199.3971	403.9825	591.3326 (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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102 (64)
Efficiency of water heater	89.8681	89.7929	89.6227	89.2402	88.5350	87.3000	87.3000	87.3000	87.3000	89.2901	89.7315	87.3000 (216)
Fuel for water heating, kWh/month	135.5633	118.8221	124.4095	112.7525	111.3845	100.5445	97.2866	107.6631	107.7172	118.5170	124.2206	131.8208 (219)
Water heating fuel used												1390.7017 (219)
Annual totals kWh/year												
Space heating fuel - main system												2779.3336 (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)	58.6472 (230a)
central heating pump	30.0000 (230c)
main heating flue fan	45.0000 (230e)
Total electricity for the above, kWh/year	133.6472 (231)
Electricity for lighting (calculated in Appendix L)	376.3269 (232)
Total delivered energy for all uses	4680.0095 (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	2779.3336	0.2160	600.3360 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1390.7017	0.2160	300.3916 (264)
Space and water heating			900.7276 (265)
Pumps and fans	133.6472	0.5190	69.3629 (267)
Energy for lighting	376.3269	0.5190	195.3137 (268)
Total CO2, kg/year			1165.4042 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.4600 (273)

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

DER		13.4600 ZC1
Total Floor Area	TFA	86.5800
Assumed number of occupants	N	2.5760
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.9228 ZC2
CO2 emissions from cooking, equation (L16)		2.0885 ZC3
Total CO2 emissions		31.4713 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		31.4713 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 209.5236 (5)
Dwelling volume			

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =		0.1432 (8)	
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.3932 (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) =				0.3637 (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	0.4637	0.4546	0.4455	0.4001	0.3910	0.3455	0.3455	0.3364	0.3637	0.3910	0.4092	0.4273	(22b)				
Effective ac	0.6075	0.6033	0.5992	0.5800	0.5764	0.5597	0.5597	0.5566	0.5661	0.5764	0.5837	0.5913	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			15.0400	1.3258	19.9394		(27)					
FP McCann System			43.2900	0.1300	5.6277		(28a)					
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.1800	13.2138		(29a)					
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.1300	5.6277		(30)					
Total net area of external elements Aum(A, m2)			177.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5586		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7094 (36)					
Total fabric heat loss						(33) + (36) =	56.2680 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0051	Feb 41.7165	Mar 41.4335	Apr 40.1045	May 39.8559	Jun 38.6984	Jul 38.6984	Aug 38.4840	Sep 39.1443	Oct 39.8559	Nov 40.3589	Dec 40.8848 (38)
Heat transfer coeff	98.2731	97.9845	97.7015	96.3725	96.1239	94.9664	94.9664	94.7520	95.4122	96.1239	96.6269	97.1528 (39)
Average = Sum(39)m / 12 =												96.3714 (39)
HLP	Jan 1.1351	Feb 1.1317	Mar 1.1285	Apr 1.1131	May 1.1102	Jun 1.0969	Jul 1.0969	Aug 1.0944	Sep 1.1020	Oct 1.1102	Nov 1.1160	Dec 1.1221 (40)
HLP (average)												1.1131 (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												2.5760 (42)
Average daily hot water use (litres/day)												95.3790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169 (44)
Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793 (45)
Energy content (annual)											Total = Sum(45)m =	1500.6825 (45)
Distribution loss	(46)m = 0.15 x (45)m											
	23.3383	20.4118	21.0632	18.3634	17.6201	15.2048	14.0895	16.1679	16.3610	19.0672	20.8133	22.6019 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	49.5762	46.0955	45.6878	42.3326	43.7437	45.6878	46.0955	49.5762	49.3151	50.9589 (61)
Solar input	206.5476	182.1062	189.9973	168.5181	163.1552	143.6980	137.6736	153.4738	155.1688	176.6906	188.0704	201.6382 (62)
	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	206.5476	182.1062	189.9973	168.5181	163.1552	143.6980	137.6736	153.4738	155.1688	176.6906	188.0704	201.6382 (64)
Heat gains from water heating, kWh/month	64.4730	56.7531	59.0841	52.2294	50.4799	44.2871	42.1676	47.2608	47.7907	54.6596	58.4649	62.8406 (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	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3092	18.9266	15.3922	11.6529	8.7107	7.3539	7.9461	10.3287	13.8632	17.6025	20.5447	21.9014	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.6433	235.0574	228.9739	216.0229	199.6746	184.3095	174.0446	171.6305	177.7140	190.6650	207.0133	222.3784	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	(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)	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	(71)
Water heating gains (Table 5)	86.6572	84.4540	79.4141	72.5408	67.8493	61.5099	56.6769	63.5226	66.3760	73.4672	81.2013	84.4632	(72)
Total internal gains	405.2490	403.0773	388.4195	364.8559	340.8739	317.8127	303.3071	310.1212	322.5926	346.3740	373.3986	393.3824	(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					
East			5.9200	19.6403	0.6300	0.7000	0.7700	35.5337 (76)					
South			1.5400	46.7521	0.6300	0.7000	0.7700	22.0036 (78)					
West			7.5800	19.6403	0.6300	0.7000	0.7700	45.4976 (80)					
Solar gains	103.0349	194.5506	306.9544	432.6081	520.6585	529.6718	505.5709	439.9793	351.5646	226.9592	127.1183	85.6493	(83)
Total gains	508.2839	597.6280	695.3740	797.4640	861.5324	847.4844	808.8780	750.1004	674.1572	573.3332	500.5169	479.0317	(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	61.1815	61.3618	61.5395	62.3881	62.5495	63.3119	63.3119	63.4551	63.0160	62.5495	62.2239	61.8871	
alpha	5.0788	5.0908	5.1026	5.1592	5.1700	5.2208	5.2208	5.2303	5.2011	5.1700	5.1483	5.1258	
util living area	0.9982	0.9956	0.9863	0.9507	0.8530	0.6762	0.5085	0.5663	0.8286	0.9751	0.9961	0.9987	(86)
MIT	19.7668	19.9306	20.2042	20.5545	20.8262	20.9620	20.9928	20.9879	20.8909	20.5186	20.0782	19.7421	(87)
Th 2	19.9723	19.9750	19.9777	19.9901	19.9925	20.0034	20.0034	20.0054	19.9992	19.9925	19.9878	19.9828	(88)
util rest of house	0.9976	0.9940	0.9815	0.9329	0.8037	0.5873	0.3976	0.4513	0.7548	0.9629	0.9945	0.9982	(89)
MIT 2	18.3265	18.5674	18.9660	19.4706	19.8249	19.9786	20.0008	20.0005	19.9127	19.4311	18.7927	18.2979	(90)
Living area fraction	18.5604	18.7887	19.1670	19.6466	19.9875	20.1383	20.1619	20.1608	20.0715	19.6077	19.0015	18.5324	(91)
MIT	18.5604	18.7887	19.1670	19.6466	19.9875	20.1383	20.1619	20.1608	20.0715	19.6077	19.0015	18.5324	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5604	18.7887	19.1670	19.6466	19.9875	20.1383	20.1619	20.1608	20.0715	19.6077	19.0015	18.5324	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9963	0.9914	0.9762	0.9254	0.8034	0.6000	0.4156	0.4699	0.7609	0.9565	0.9922	0.9972	(94)
Ext temp.	506.4030	592.5137	678.8008	737.9423	692.1726	508.5254	336.1753	352.4974	512.9772	548.3845	496.5910	477.7058	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1401.4121	1360.8819	1237.5881	1035.6795	796.6300	525.9558	338.2608	356.3480	569.7556	865.8529	1150.0016	1392.4329	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	665.8868	516.3434	415.7378	214.3708	77.7163	0.0000	0.0000	0.0000	0.0000	236.1965	470.4556	680.5570	(98)
Space heating per m2												3277.2642	(98)
												37.8524	(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													3508.8482 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	665.8868	516.3434	415.7378	214.3708	77.7163	0.0000	0.0000	0.0000	0.0000	236.1965	470.4556	680.5570	(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)	712.9409	552.8302	445.1154	229.5190	83.2080	0.0000	0.0000	0.0000	0.0000	252.8871	503.6998	728.6477	(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	206.5476	182.1062	189.9973	168.5181	163.1552	143.6980	137.6736	153.4738	155.1688	176.6906	188.0704	201.6382	(64)
Efficiency of water heater (217)m	87.7859	87.5295	86.9689	85.6581	83.3029	80.3000	80.3000	80.3000	80.3000	85.7827	87.2653	87.8738	(216)
Fuel for water heating, kWh/month	235.2855	208.0512	218.4659	196.7333	195.8578	178.9514	171.4491	191.1256	193.2364	205.9746	215.5157	229.4635	(219)
Water heating fuel used												2440.1098	(219)
Annual totals kWh/year													
Space heating fuel - main system												3508.8482	(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)												376.3269	(232)
Total delivered energy for all uses												6400.2849	(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	3508.8482	0.2160	757.9112 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2440.1098	0.2160	527.0637 (264)
Space and water heating			1284.9749 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	376.3269	0.5190	195.3137 (268)
Total CO2, kg/m2/year			1519.2136 (272)
Emissions per m2 for space and water heating			14.8415 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2559 (272b)
Emissions per m2 for pumps and fans			0.4496 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8415 * 1.00) + 2.2559 + 0.4496, rounded to 2 d.p.			17.5500 (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	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.5236 (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) = 0.1432 (8)
Pressure test					Yes
Measured/design AP50					4.0100
Infiltration rate					0.3437 (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) =	0.3179 (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	0.4053	0.3974	0.3894	0.3497	0.3417	0.3020	0.3020	0.2941	0.3179	0.3417	0.3576	0.3735 (22b)
Effective ac	0.5821	0.5790	0.5758	0.5611	0.5584	0.5456	0.5456	0.5432	0.5505	0.5584	0.5640	0.5698 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Window (Uw = 1.20)			11.9500	1.1450	13.6832		(27)
French Door (Uw = 1.40)			3.0900	1.3258	4.0966		(27)
Front Door			2.1500	1.0000	2.1500		(26)
FP McCann System			43.2900	0.1100	4.7619	75.0000	3246.7500 (28a)
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.2500	18.3525	52.8000	3876.0480 (29a)
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.0900	3.8961	9.0000	389.6100 (30)
Total net area of external elements Aum(A, m ²)			177.1800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9403		(33)
E-WM-30			40.3600	0.0000	0.0000	45.0000	1816.2000 (32)
1F Timber			101.1200			9.0000	910.0800 (32c)
GF Timber			57.3800			9.0000	516.4200 (32c)
GF Masonry			19.2700			39.0000	751.5300 (32c)
Internal Floor			43.2900			12.6000	545.4540 (32d)
Internal Ceiling			43.2900			9.0000	389.6100 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12441.7020 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							143.7018 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0482 (36)
Total fabric heat loss						(33) + (36) =	51.9885 (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	40.2512	40.0307	39.8145	38.7990	38.6091	37.7247	37.7247	37.5609	38.0653	38.6091	38.9934	39.3952 (38)
Heat transfer coeff	92.2397	92.0192	91.8030	90.7875	90.5976	89.7132	89.7132	89.5494	90.0538	90.5976	90.9819	91.3837 (39)
Average = Sum(39)m / 12 =												90.7866 (39)
HLP	1.0654	1.0628	1.0603	1.0486	1.0464	1.0362	1.0362	1.0343	1.0401	1.0464	1.0508	1.0555 (40)
HLP (average)												1.0486 (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												2.5760 (42)
Average daily hot water use (litres/day)												95.3790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169 (44)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793 (45)
Energy content (annual)										Total =	Sum (45)m =	1500.6825 (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	33.0626	28.9168	29.8395	26.0148	24.9618	21.5402	19.9601	22.9045	23.1781	27.0118	29.4855	32.0194 (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	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3092	18.9266	15.3922	11.6529	8.7107	7.3539	7.9461	10.3287	13.8632	17.6025	20.5447	21.9014 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.6433	235.0574	228.9739	216.0229	199.6746	184.3095	174.0446	171.6305	177.7140	190.6650	207.0133	222.3784 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798 (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)	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383 (71)
Water heating gains (Table 5)	44.4390	43.0309	40.1069	36.1317	33.5508	29.9169	26.8281	30.7857	32.1918	36.3062	40.9521	43.0368 (72)
Total internal gains	360.0308	358.6543	346.1123	325.4468	303.5754	283.2196	270.4583	274.3842	285.4083	306.2130	330.1495	348.9560 (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
East					5.9200	19.6403	0.4600		0.0000		0.7700	41.1830 (76)
South					1.5400	46.7521	0.4600		0.0000		0.7700	25.5018 (78)
West					4.4900	19.6403	0.4600		0.0000		0.7700	31.2351 (80)
West					3.0900	19.6403	0.4300		0.0000		0.7700	20.0939 (80)
Solar gains	118.0137	222.7383	351.2383	494.7982	595.3615	605.6165	578.0804	503.1702	402.2044	259.7875	145.5798	98.1132 (83)
Total gains	478.0445	581.3926	697.3506	820.2450	898.9369	888.8362	848.5386	777.5545	687.6127	566.0005	475.7293	447.0692 (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	37.4679	37.5577	37.6462	38.0672	38.1470	38.5231	38.5231	38.5935	38.3774	38.1470	37.9859	37.8189
alpha	3.4979	3.5038	3.5097	3.5378	3.5431	3.5682	3.5682	3.5729	3.5585	3.5431	3.5324	3.5213
util living area	0.9884	0.9767	0.9479	0.8773	0.7540	0.5903	0.4485	0.5025	0.7395	0.9272	0.9800	0.9908 (86)
MIT	19.2136	19.4706	19.8775	20.3631	20.7229	20.9166	20.9761	20.9643	20.8098	20.2980	19.6589	19.1677 (87)
Th 2	20.0292	20.0313	20.0334	20.0430	20.0448	20.0533	20.0533	20.0549	20.0500	20.0448	20.0412	20.0374 (88)
util rest of house	0.9861	0.9721	0.9376	0.8533	0.7081	0.5190	0.3587	0.4096	0.6750	0.9076	0.9753	0.9889 (89)
MIT 2	18.3908	18.6466	19.0474	19.5190	19.8439	20.0061	20.0441	20.0400	19.9293	19.4697	18.8429	18.3512 (90)
Living area fraction									fLA =	Living area / (4) =		0.1624 (91)
MIT	18.5244	18.7804	19.1822	19.6561	19.9866	20.1540	20.1954	20.1901	20.0723	19.6042	18.9754	18.4838 (92)
Temperature adjustment												0.0000
adjusted MIT	18.5244	18.7804	19.1822	19.6561	19.9866	20.1540	20.1954	20.1901	20.0723	19.6042	18.9754	18.4838 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9812	0.9644	0.9263	0.8421	0.7050	0.5270	0.3726	0.4235	0.6767	0.8965	0.9684	0.9848 (94)
Useful gains	469.0581	560.7013	645.9822	690.7061	633.7779	468.3809	316.1412	329.2824	465.2818	507.4077	460.6772	440.2595 (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	1312.0555	1277.2656	1164.2638	976.5206	750.7472	498.2658	322.5577	339.4036	537.8245	815.7602	1080.4469	1305.3083 (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	627.1901	481.5312	385.6015	205.7864	87.0252	0.0000	0.0000	0.0000	0.0000	229.4142	446.2341	643.5963 (98)
Space heating												3106.3791 (98)
Space heating per m2										(98) / (4) =		35.8787 (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	843.3037	663.8774	680.5753	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8803	0.9251	0.9037	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	742.3457	614.1289	615.0372	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1135.8047	1086.6908	1005.4443	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	283.2905	351.5860	290.4628	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												925.3393	(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	70.8226	87.8965	72.6157	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												231.3348	(107)
Space cooling per m2												2.6719	(108)
Energy for space heating												35.8787	(99)
Energy for space cooling												2.6719	(108)
Total												38.5506	(109)
Dwelling Fabric Energy Efficiency (DFEE)												38.6	(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	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 209.5236 (5)
Dwelling volume			

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							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1432 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3932 (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) =	0.3637 (21)				
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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	0.4637	0.4546	0.4455	0.4001	0.3910	0.3455	0.3455	0.3364	0.3637	0.3910	0.4092	0.4273 (22b)
Effective ac	0.6075	0.6033	0.5992	0.5800	0.5764	0.5597	0.5597	0.5566	0.5661	0.5764	0.5837	0.5913 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			15.0400	1.3258	19.9394		(27)					
FP McCann System			43.2900	0.1300	5.6277		(28a)					
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.1800	13.2138		(29a)					
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.1300	5.6277		(30)					
Total net area of external elements Aum(A, m2)			177.1800				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.5586		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7094 (36)					
Total fabric heat loss						(33) + (36) =	56.2680 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.0051	Feb 41.7165	Mar 41.4335	Apr 40.1045	May 39.8559	Jun 38.6984	Jul 38.6984	Aug 38.4840	Sep 39.1443	Oct 39.8559	Nov 40.3589	Dec 40.8848 (38)
Heat transfer coeff	98.2731	97.9845	97.7015	96.3725	96.1239	94.9664	94.9664	94.7520	95.4122	96.1239	96.6269	97.1528 (39)
Average = Sum(39)m / 12 =												96.3714 (39)
HLP	Jan 1.1351	Feb 1.1317	Mar 1.1285	Apr 1.1131	May 1.1102	Jun 1.0969	Jul 1.0969	Aug 1.0944	Sep 1.1020	Oct 1.1102	Nov 1.1160	Dec 1.1221 (40)
HLP (average)												1.1131 (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												2.5760 (42)
Average daily hot water use (litres/day)												95.3790 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169 (44)
Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793 (45)
Energy content (annual)											Total = Sum(45)m =	1500.6825 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	33.0626	28.9168	29.8395	26.0148	24.9618	21.5402	19.9601	22.9045	23.1781	27.0118	29.4855	32.0194 (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	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978	128.7978 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.3092	18.9266	15.3922	11.6529	8.7107	7.3539	7.9461	10.3287	13.8632	17.6025	20.5447	21.9014 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	232.6433	235.0574	228.9739	216.0229	199.6746	184.3095	174.0446	171.6305	177.7140	190.6650	207.0133	222.3784 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798	35.8798 (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)	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383 (71)
Water heating gains (Table 5)	44.4390	43.0309	40.1069	36.1317	33.5508	29.9169	26.8281	30.7857	32.1918	36.3062	40.9521	43.0368 (72)
Total internal gains	360.0308	358.6543	346.1123	325.4468	303.5754	283.2196	270.4583	274.3842	285.4083	306.2130	330.1495	348.9560 (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			
East				5.9200	19.6403	0.6300	0.7000	0.7700	35.5337 (76)			
South				1.5400	46.7521	0.6300	0.7000	0.7700	22.0036 (78)			
West				7.5800	19.6403	0.6300	0.7000	0.7700	45.4976 (80)			
Solar gains	103.0349	194.5506	306.9544	432.6081	520.6585	529.6718	505.5709	439.9793	351.5646	226.9592	127.1183	85.6493 (83)
Total gains	463.0657	553.2049	653.0667	758.0549	824.2339	812.8914	776.0292	714.3635	636.9729	533.1722	457.2677	434.6053 (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	61.1815	61.3618	61.5395	62.3881	62.5495	63.3119	63.3119	63.4551	63.0160	62.5495	62.2239	61.8871
alpha	5.0788	5.0908	5.1026	5.1592	5.1700	5.2208	5.2208	5.2303	5.2011	5.1700	5.1483	5.1258
util living area	0.9988	0.9969	0.9895	0.9592	0.8699	0.6982	0.5284	0.5913	0.8523	0.9815	0.9974	0.9992 (86)
MIT	19.7180	19.8833	20.1610	20.5206	20.8067	20.9560	20.9915	20.9853	20.8736	20.4795	20.0318	19.6939 (87)
Th 2	19.9723	19.9750	19.9777	19.9901	19.9925	20.0034	20.0034	20.0054	19.9992	19.9925	19.9878	19.9828 (88)
util rest of house	0.9984	0.9958	0.9857	0.9438	0.8236	0.6089	0.4140	0.4729	0.7828	0.9720	0.9964	0.9989 (89)
MIT 2	18.8000	18.9669	19.2447	19.6043	19.8632	19.9835	20.0013	20.0013	19.9289	19.5723	19.1258	18.7844 (90)
Living area fraction									fLA = Living area / (4) =			0.1624 (91)
MIT	18.9490	19.1157	19.3935	19.7531	20.0165	20.1414	20.1621	20.1611	20.0823	19.7196	19.2729	18.9321 (92)
Temperature adjustment												0.0000
adjusted MIT	18.9490	19.1157	19.3935	19.7531	20.0165	20.1414	20.1621	20.1611	20.0823	19.7196	19.2729	18.9321 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9979	0.9945	0.9828	0.9394	0.8248	0.6221	0.4327	0.4922	0.7895	0.9686	0.9953	0.9985 (94)
Ext temp.	462.0755	550.1636	641.8538	712.0864	679.8658	505.7057	335.7614	351.6040	502.8693	516.4151	455.1038	433.9324 (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	1439.6080	1392.9208	1259.7161	1045.9408	799.4102	526.2483	338.2759	356.3674	570.7845	876.6112	1176.2333	1431.2619 (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	727.2842	566.3328	459.6895	240.3752	88.9410	0.0000	0.0000	0.0000	0.0000	267.9859	519.2133	742.0131 (98)
Space heating												3611.8351 (98)
Space heating per m2										(98) / (4) =		41.7167 (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	892.6841	702.7513	720.1155	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8981	0.9473	0.9261	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	801.7272	665.7387	666.8980	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1047.0381	1001.9395	931.5847	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	176.6239	250.1333	196.9269	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												623.6841 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	44.1560	62.5333	49.2317	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												155.9210 (107)
Space cooling per m2												1.8009 (108)
Energy for space heating												41.7167 (99)
Energy for space cooling												1.8009 (108)
Total												43.5176 (109)
Target Fabric Energy Efficiency (TFEE)												50.0 (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	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.5236 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.9500	1.1450	13.6832			(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			43.2900	0.1100	4.7619	75.0000	3246.7500	(28a)					
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.2500	18.3525	52.8000	3876.0480	(29a)					
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.0900	3.8961	9.0000	389.6100	(30)					
Total net area of external elements Aum(A, m2)			177.1800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9403			(33)					
E-WM-30			40.3600	0.0000	0.0000	45.0000	1816.2000	(32)					
1F Timber			101.1200			9.0000	910.0800	(32c)					
GF Timber			57.3800			9.0000	516.4200	(32c)					
GF Masonry			19.2700			39.0000	751.5300	(32c)					
Internal Floor			43.2900			12.6000	545.4540	(32d)					
Internal Ceiling			43.2900			9.0000	389.6100	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12441.7020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.7018	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0482	(36)					
Total fabric heat loss						(33) + (36) =	51.9885	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.5714	Feb 34.5714	Mar 34.5714	Apr 34.5714	May 34.5714	Jun 34.5714	Jul 34.5714	Aug 34.5714	Sep 34.5714	Oct 34.5714	Nov 34.5714	Dec 34.5714	(38)
Heat transfer coeff	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	(39)
Average = Sum(39)m / 12 =												86.5599	(39)
HLP	Jan 0.9998	Feb 0.9998	Mar 0.9998	Apr 0.9998	May 0.9998	Jun 0.9998	Jul 0.9998	Aug 0.9998	Sep 0.9998	Oct 0.9998	Nov 0.9998	Dec 0.9998	(40)
HLP (average)												0.9998	(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	2.5760 (42)
Average daily hot water use (litres/day)	95.3790 (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	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169	(44)
Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793	(45)
Energy content (annual)	Total = Sum(45)m = 1500.6825												(45)
Distribution loss (46)m = 0.15 x (45)m	23.3383	20.4118	21.0632	18.3634	17.6201	15.2048	14.0895	16.1679	16.3610	19.0672	20.8133	22.6019	(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	14.1300	12.7519	14.0844	13.5874	14.0093	13.5216	13.9501	13.9885	13.5575	14.0534	13.6458	14.1182	(61)
Total heat required for water heating calculated for each month	169.7186	148.8307	154.5056	136.0100	131.4767	114.8871	107.8800	121.7745	122.6308	141.1678	152.4012	164.7975	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =	0.0000												(63)
Output from w/h	169.7186	148.8307	154.5056	136.0100	131.4767	114.8871	107.8800	121.7745	122.6308	141.1678	152.4012	164.7975	(64)
Total per year (kWh/year) = Sum(64)m =	1666.0805												(64)
RHI water heating demand	1666												(64)
Heat gains from water heating, kWh/month	55.2657	48.4342	50.2111	44.1024	42.5602	37.0844	34.7192	39.3360	39.6562	45.7789	49.5476	53.6304	(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	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2730	47.3166	38.4804	29.1322	21.7766	18.3848	19.8654	25.8218	34.6579	44.0062	51.3617	54.7536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.2288	350.8319	341.7521	322.4223	298.0218	275.0888	259.7681	256.1650	265.2448	284.5747	308.9751	331.9081	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	(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)	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	(71)
Water heating gains (Table 5)	74.2819	72.0747	67.4881	61.2533	57.2046	51.5061	46.6656	52.8709	55.0781	61.5308	68.8161	72.0839	(72)
Total internal gains	582.3345	577.7740	555.2715	520.3585	484.5539	452.5305	433.8500	442.4085	462.5317	497.6624	536.7038	566.2964	(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		
East					5.9200	22.3313		0.4600	0.0000	0.7700	46.8257 (76)		
South					1.5400	50.9848		0.4600	0.0000	0.7700	27.8106 (78)		
West					4.4900	22.3313		0.4600	0.0000	0.7700	35.5148 (80)		
West					3.0900	22.3313		0.4300	0.0000	0.7700	22.8471 (80)		

Solar gains	132.9983	225.9682	351.9079	510.4669	598.0808	650.9939	614.7008	547.3321	436.6651	281.4024	168.1078	109.4816 (83)	
Total gains	715.3327	803.7422	907.1793	1030.8255	1082.6346	1103.5244	1048.5507	989.7406	899.1967	779.0648	704.8116	675.7780 (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	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	
Feb	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	
alpha	0.9541	0.9312	0.8744	0.7570	0.5884	0.3844	0.2546	0.2780	0.5271	0.8022	0.9241	0.9610	(86)
util living area	19.8176	20.0038	20.3456	20.6925	20.9054	20.9853	20.9977	20.9968	20.9521	20.6784	20.1922	19.7612	(87)
MIT	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	(88)
util rest of house	0.9459	0.9194	0.8534	0.7203	0.5334	0.3169	0.1800	0.1993	0.4539	0.7617	0.9086	0.9538	(89)
MIT 2	18.5351	18.7987	19.2755	19.7365	19.9945	20.0742	20.0828	20.0824	20.0472	19.7318	19.0713	18.4550	(90)
Living area fraction	18.7434	18.9944	19.4493	19.8918	20.1424	20.2222	20.2314	20.2309	20.1942	19.8855	19.2533	18.6671	(91)
MIT	18.7434	18.9944	19.4493	19.8918	20.1424	20.2222	20.2314	20.2309	20.1942	19.8855	19.2533	18.6671	(92)
Temperature adjustment	18.5934	18.8444	19.2993	19.7418	19.9924	20.0722	20.0814	20.0809	20.0442	19.7355	19.1033	-0.1500	
adjusted MIT	18.5934	18.8444	19.2993	19.7418	19.9924	20.0722	20.0814	20.0809	20.0442	19.7355	19.1033	18.5171	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9283	0.8993	0.8323	0.7052	0.5277	0.3161	0.1798	0.1990	0.4506	0.7442	0.8880	0.9374	(94)
Useful gains	664.0790	722.8412	755.0725	726.9606	571.2636	348.7933	188.5282	197.0047	405.2106	579.7548	625.8426	633.4887	(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	1167.9833	1146.4342	1030.0021	851.9030	605.2623	352.4850	188.8190	197.4367	419.3093	704.2068	961.1039	1161.3862	(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	374.9048	284.6545	204.5476	89.9585	25.2950	0.0000	0.0000	0.0000	0.0000	92.5923	241.3881	392.7558	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Space heating
RHI space heating demand

1706.0967 (98)
1706 (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	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.5236 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.9500	1.1450	13.6832			(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			43.2900	0.1100	4.7619	75.0000	3246.7500	(28a)					
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.2500	18.3525	52.8000	3876.0480	(29a)					
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.0900	3.8961	9.0000	389.6100	(30)					
Total net area of external elements Aum(A, m2)			177.1800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9403			(33)					
E-WM-30			40.3600	0.0000	0.0000	45.0000	1816.2000	(32)					
1F Timber			101.1200			9.0000	910.0800	(32c)					
GF Timber			57.3800			9.0000	516.4200	(32c)					
GF Masonry			19.2700			39.0000	751.5300	(32c)					
Internal Floor			43.2900			12.6000	545.4540	(32d)					
Internal Ceiling			43.2900			9.0000	389.6100	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12441.7020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.7018	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0482	(36)					
Total fabric heat loss						(33) + (36) =	51.9885	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.5714	Feb 34.5714	Mar 34.5714	Apr 34.5714	May 34.5714	Jun 34.5714	Jul 34.5714	Aug 34.5714	Sep 34.5714	Oct 34.5714	Nov 34.5714	Dec 34.5714	(38)
Heat transfer coeff	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	(39)
Average = Sum(39)m / 12 =												86.5599	(39)
HLP	Jan 0.9998	Feb 0.9998	Mar 0.9998	Apr 0.9998	May 0.9998	Jun 0.9998	Jul 0.9998	Aug 0.9998	Sep 0.9998	Oct 0.9998	Nov 0.9998	Dec 0.9998	(40)
HLP (average)												0.9998	(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	2.5760 (42)
Average daily hot water use (litres/day)	95.3790 (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	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169	(44)
Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793	(45)
Energy content (annual)										Total =	Sum (45)m =	1500.6825	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3383	20.4118	21.0632	18.3634	17.6201	15.2048	14.0895	16.1679	16.3610	19.0672	20.8133	22.6019	(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	14.1300	12.7519	14.0844	13.5874	14.0093	13.5216	13.9501	13.9885	13.5575	14.0534	13.6458	14.1182	(61)
Total heat required for water heating calculated for each month	169.7186	148.8307	154.5056	136.0100	131.4767	114.8871	107.8800	121.7745	122.6308	141.1678	152.4012	164.7975	(62)
WWHRS	-47.8906	-42.1368	-43.0065	-35.3895	-32.8624	-27.1117	-22.9488	-27.7846	-28.5937	-35.3438	-40.9362	-46.2873	eq. (G10)
Total of WWHRS savings												-430.2918	
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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102	(64)
Heat gains from water heating, kWh/month	55.2657	48.4342	50.2111	44.1024	42.5602	37.0844	34.7192	39.3360	39.6562	45.7789	49.5476	53.6304	(65)
Total per year (kWh/year) =										Sum (64)m =		1235.7887	(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	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2730	47.3166	38.4804	29.1322	21.7766	18.3848	19.8654	25.8218	34.6579	44.0062	51.3617	54.7536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.2288	350.8319	341.7521	322.4223	298.0218	275.0888	259.7681	256.1650	265.2448	284.5747	308.9751	331.9081	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	(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)	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	(71)
Water heating gains (Table 5)	74.2819	72.0747	67.4881	61.2533	57.2046	51.5061	46.6656	52.8709	55.0781	61.5308	68.8161	72.0839	(72)
Total internal gains	582.3345	577.7740	555.2715	520.3585	484.5539	452.5305	433.8500	442.4085	462.5317	497.6624	536.7038	566.2964	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W			
East				5.9200	19.6403	0.4600	0.0000	0.7700	41.1830 (76)			
South				1.5400	46.7521	0.4600	0.0000	0.7700	25.5018 (78)			
West				4.4900	19.6403	0.4600	0.0000	0.7700	31.2351 (80)			
West				3.0900	19.6403	0.4300	0.0000	0.7700	20.0939 (80)			
Solar gains	118.0137	222.7383	351.2383	494.7982	595.3615	605.6165	578.0804	503.1702	402.2044	259.7875	145.5798	98.1132 (83)
Total gains	700.3482	800.5123	906.5098	1015.1567	1079.9153	1058.1470	1011.9303	945.5787	864.7361	757.4499	682.2836	664.4096 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	
alpha	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	
util living area	0.9624	0.9396	0.8919	0.7976	0.6587	0.4990	0.3697	0.4106	0.6236	0.8476	0.9416	0.9683	(86)
MIT	19.6852	19.9068	20.2389	20.5949	20.8403	20.9558	20.9886	20.9832	20.9012	20.5599	20.0444	19.6182	(87)
Th 2	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	(88)
util rest of house	0.9559	0.9294	0.8742	0.7664	0.6110	0.4351	0.2955	0.3330	0.5585	0.8159	0.9300	0.9627	(89)
MIT 2	18.3443	18.6600	19.1268	19.6093	19.9192	20.0480	20.0772	20.0736	19.9962	19.5771	18.8621	18.2483	(90)
Living area fraction										fLA = Living area / (4) =		0.1624	(91)
MIT	18.5621	18.8625	19.3074	19.7694	20.0688	20.1954	20.2252	20.2213	20.1431	19.7367	19.0541	18.4708	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4121	18.7125	19.1574	19.6194	19.9188	20.0454	20.0752	20.0713	19.9931	19.5867	18.9041	18.3208	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9399	0.9101	0.8530	0.7489	0.6019	0.4324	0.2948	0.3319	0.5516	0.7958	0.9107	0.9480	(94)
Useful gains	658.2271	728.5322	773.2245	760.2124	649.9862	457.5052	298.3183	313.8723	476.9984	602.7938	621.3420	629.8563	(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	1221.5377	1195.6062	1095.6243	927.8679	711.4157	471.3539	300.8153	317.7888	510.1089	777.8880	1021.7614	1222.2923	(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

419.1031	313.8738	239.8655	120.7119	45.7035	0.0000	0.0000	0.0000	0.0000	130.2701	288.3020	440.7724 (98)
Space heating											1998.6021 (98)
Space heating per m2											(98) / (4) = 23.0839 (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												2208.4002 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	419.1031	313.8738	239.8655	120.7119	45.7035	0.0000	0.0000	0.0000	0.0000	130.2701	288.3020	440.7724 (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)	463.0973	346.8218	265.0447	133.3834	50.5011	0.0000	0.0000	0.0000	0.0000	143.9448	318.5657	487.0413 (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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102 (64)
Efficiency of water heater (217)m	89.7590	89.6662	89.4594	89.0166	88.2886	87.3000	87.3000	87.3000	87.3000	89.0371	89.5844	87.3000 (216)
Fuel for water heating, kWh/month	135.7280	118.9901	124.6365	113.0357	111.6953	100.5445	97.2866	107.6631	107.7172	118.8537	124.4245	89.8025 (217)
Water heating fuel used												131.9676 (219)
Annual totals kWh/year												1392.5430 (219)
Space heating fuel - main system												2208.4002 (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)												58.6472 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												133.6472 (231)
Electricity for lighting (calculated in Appendix L)												376.3269 (232)
Total delivered energy for all uses												4110.9173 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2208.4002	3.4800	76.8523 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1392.5430	3.4800	48.4605 (247)
Mechanical ventilation fans	58.6472	13.1900	7.7356 (249)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	376.3269	13.1900	49.6375 (250)
Additional standing charges			120.0000 (251)
Total energy cost			312.5784 (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] = 0.9977 (257)
SAP value	86.0815
SAP rating (Section 12)	86 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2208.4002	0.2160	477.0144 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1392.5430	0.2160	300.7893 (264)
Space and water heating			777.8037 (265)
Pumps and fans	133.6472	0.5190	69.3629 (267)
Energy for lighting	376.3269	0.5190	195.3137 (268)
Total kg/year			1042.4803 (272)
CO2 emissions per m2			12.0400 (273)
EI value			89.3835
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 $3.48 / 0.8865 = 3.925$, 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	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.5236 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.9500	1.1450	13.6832			(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			43.2900	0.1100	4.7619	75.0000	3246.7500	(28a)					
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.2500	18.3525	52.8000	3876.0480	(29a)					
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.0900	3.8961	9.0000	389.6100	(30)					
Total net area of external elements Aum(A, m2)			177.1800					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9403			(33)					
E-WM-30			40.3600	0.0000	0.0000	45.0000	1816.2000	(32)					
1F Timber			101.1200			9.0000	910.0800	(32c)					
GF Timber			57.3800			9.0000	516.4200	(32c)					
GF Masonry			19.2700			39.0000	751.5300	(32c)					
Internal Floor			43.2900			12.6000	545.4540	(32d)					
Internal Ceiling			43.2900			9.0000	389.6100	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12441.7020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.7018	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0482	(36)					
Total fabric heat loss						(33) + (36) =	51.9885	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.5714	Feb 34.5714	Mar 34.5714	Apr 34.5714	May 34.5714	Jun 34.5714	Jul 34.5714	Aug 34.5714	Sep 34.5714	Oct 34.5714	Nov 34.5714	Dec 34.5714	(38)
Heat transfer coeff	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	(39)
Average = Sum(39)m / 12 =												86.5599	(39)
HLP	Jan 0.9998	Feb 0.9998	Mar 0.9998	Apr 0.9998	May 0.9998	Jun 0.9998	Jul 0.9998	Aug 0.9998	Sep 0.9998	Oct 0.9998	Nov 0.9998	Dec 0.9998	(40)
HLP (average)												0.9998	(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	2.5760 (42)
Average daily hot water use (litres/day)	95.3790 (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	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169	(44)
Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793	(45)
Energy content (annual)	Total = Sum (45)m = 1500.6825												(45)
Distribution loss (46)m = 0.15 x (45)m	23.3383	20.4118	21.0632	18.3634	17.6201	15.2048	14.0895	16.1679	16.3610	19.0672	20.8133	22.6019	(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	14.1300	12.7519	14.0844	13.5874	14.0093	13.5216	13.9501	13.9885	13.5575	14.0534	13.6458	14.1182	(61)
Total heat required for water heating calculated for each month	169.7186	148.8307	154.5056	136.0100	131.4767	114.8871	107.8800	121.7745	122.6308	141.1678	152.4012	164.7975	(62)
WWHRS	-47.8906	-42.1368	-43.0065	-35.3895	-32.8624	-27.1117	-22.9488	-27.7846	-28.5937	-35.3438	-40.9362	-46.2873	eq. (G10)
Total of WWHRS savings	-430.2918												
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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102	(64)
Heat gains from water heating, kWh/month	55.2657	48.4342	50.2111	44.1024	42.5602	37.0844	34.7192	39.3360	39.6562	45.7789	49.5476	53.6304	(65)
Total per year (kWh/year) = Sum (64)m = 1235.7887													(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	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2730	47.3166	38.4804	29.1322	21.7766	18.3848	19.8654	25.8218	34.6579	44.0062	51.3617	54.7536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.2288	350.8319	341.7521	322.4223	298.0218	275.0888	259.7681	256.1650	265.2448	284.5747	308.9751	331.9081	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	(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)	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	(71)
Water heating gains (Table 5)	74.2819	72.0747	67.4881	61.2533	57.2046	51.5061	46.6656	52.8709	55.0781	61.5308	68.8161	72.0839	(72)
Total internal gains	582.3345	577.7740	555.2715	520.3585	484.5539	452.5305	433.8500	442.4085	462.5317	497.6624	536.7038	566.2964	(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	
East				5.9200	22.3313	0.4600	0.0000		0.7700		46.8257 (76)	
South				1.5400	50.9848	0.4600	0.0000		0.7700		27.8106 (78)	
West				4.4900	22.3313	0.4600	0.0000		0.7700		35.5148 (80)	
West				3.0900	22.3313	0.4300	0.0000		0.7700		22.8471 (80)	
Solar gains	132.9983	225.9682	351.9079	510.4669	598.0808	650.9939	614.7008	547.3321	436.6651	281.4024	168.1078	109.4816 (83)
Total gains	715.3327	803.7422	907.1793	1030.8255	1082.6346	1103.5244	1048.5507	989.7406	899.1967	779.0648	704.8116	675.7780 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264		
alpha	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618		
util living area	0.9541	0.9312	0.8744	0.7570	0.5884	0.3844	0.2546	0.2780	0.5271	0.8022	0.9241	0.9610	(86)	
MIT	19.8176	20.0038	20.3456	20.6925	20.9054	20.9853	20.9977	20.9968	20.9521	20.6784	20.1922	19.7612	(87)	
Th 2	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	(88)	
util rest of house	0.9459	0.9194	0.8534	0.7203	0.5334	0.3169	0.1800	0.1993	0.4539	0.7617	0.9086	0.9538	(89)	
MIT 2	18.5351	18.7987	19.2755	19.7365	19.9945	20.0742	20.0828	20.0824	20.0472	19.7318	19.0713	18.4550	(90)	
Living area fraction	fLA = Living area / (4) =												0.1624	(91)
MIT	18.7434	18.9944	19.4493	19.8918	20.1424	20.2222	20.2314	20.2309	20.1942	19.8855	19.2533	18.6671	(92)	
Temperature adjustment	-0.1500													
adjusted MIT	18.5934	18.8444	19.2993	19.7418	19.9924	20.0722	20.0814	20.0809	20.0442	19.7355	19.1033	18.5171	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9283	0.8993	0.8323	0.7052	0.5277	0.3161	0.1798	0.1990	0.4506	0.7442	0.8880	0.9374	(94)
Useful gains	664.0790	722.8412	755.0725	726.9606	571.2636	348.7933	188.5282	197.0047	405.2106	579.7548	625.8426	633.4887	(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	1167.9833	1146.4342	1030.0021	851.9030	605.2623	352.4850	188.8190	197.4367	419.3093	704.2068	961.1039	1161.3862	(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	374.9048	284.6545	204.5476	89.9585	25.2950	0.0000	0.0000	0.0000	0.0000	92.5923	241.3881	392.7558 (98)
Space heating per m2												1706.0967 (98)
											(98) / (4) =	19.7054 (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												1885.1898 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	374.9048	284.6545	204.5476	89.9585	25.2950	0.0000	0.0000	0.0000	0.0000	92.5923	241.3881	392.7558 (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)	414.2595	314.5353	226.0195	99.4017	27.9503	0.0000	0.0000	0.0000	0.0000	102.3119	266.7272	433.9843 (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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102 (64)
Efficiency of water heater (217)m	89.6937	89.6045	89.3446	88.7818	87.9347	87.3000	87.3000	87.3000	87.3000	88.7647	89.4641	87.3000 (216)
Fuel for water heating, kWh/month	135.8269	119.0719	124.7966	113.3347	112.1449	100.5445	97.2866	107.6631	107.7172	119.2186	124.5919	132.0631 (219)
Water heating fuel used												1394.2601 (219)
Annual totals kWh/year												
Space heating fuel - main system												1885.1898 (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)												58.6472 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												133.6472 (231)
Electricity for lighting (calculated in Appendix L)												376.3269 (232)
Total delivered energy for all uses												3789.4240 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1885.1898	3.9200	73.8994 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1394.2601	3.9200	54.6550 (247)
Mechanical ventilation fans	58.6472	16.9600	9.9466 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	376.3269	16.9600	63.8250 (250)
Additional standing charges			88.0000 (251)
Total energy cost			303.0461 (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	1885.1898	0.2160	407.2010 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1394.2601	0.2160	301.1602 (264)
Space and water heating			708.3612 (265)
Pumps and fans	133.6472	0.5190	69.3629 (267)
Energy for lighting	376.3269	0.5190	195.3137 (268)
Total kg/year			973.0378 (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	1885.1898	1.2200	2299.9315 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1394.2601	1.2200	1700.9973 (264)
Space and water heating			4000.9288 (265)
Pumps and fans	133.6472	3.0700	410.2970 (267)
Energy for lighting	376.3269	3.0700	1155.3237 (268)
Primary energy kWh/year			5566.5495 (272)
Primary energy kWh/m2/year			64.2937 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 86
Current environmental impact rating: B 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	+ 10.1	-£ 309	-947 kg (97.3%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.9	-£ 22	-140 kg (14.3%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£309 10.93 kg/m ²	A 96	A 99
Total Savings	£309 10.93 kg/m ²		

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 99

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	£86	£86	£0
Mains gas	£217	£217	£0
Space heating	£185	£185	£0
Water heating	£55	£55	£0
Lighting	£64	£64	£0
Generated (PV)	-£0	-£309	£309
Total cost of fuels	£303	-£6	£309
Total cost of uses	£304	-£5	£309
Delivered energy	44 kWh/m ²	23 kWh/m ²	21 kWh/m ²
Carbon dioxide emissions	1.0 tonnes	0.0 tonnes	0.9 tonnes
CO2 emissions per m ²	11 kg/m ²	0 kg/m ²	11 kg/m ²
Primary energy	64 kWh/m ²	0 kWh/m ²	65 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	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.5236 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.9500	1.1450	13.6832			(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			43.2900	0.1100	4.7619	75.0000	3246.7500	(28a)					
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.2500	18.3525	52.8000	3876.0480	(29a)					
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.0900	3.8961	9.0000	389.6100	(30)					
Total net area of external elements Aum(A, m2)			177.1800					(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.9403			(33)					
E-WM-30			40.3600	0.0000	0.0000	45.0000	1816.2000	(32)					
1F Timber			101.1200			9.0000	910.0800	(32c)					
GF Timber			57.3800			9.0000	516.4200	(32c)					
GF Masonry			19.2700			39.0000	751.5300	(32c)					
Internal Floor			43.2900			12.6000	545.4540	(32d)					
Internal Ceiling			43.2900			9.0000	389.6100	(32e)					
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		12441.7020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.7018	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0482	(36)					
Total fabric heat loss						(33) + (36) =	51.9885	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.5714	Feb 34.5714	Mar 34.5714	Apr 34.5714	May 34.5714	Jun 34.5714	Jul 34.5714	Aug 34.5714	Sep 34.5714	Oct 34.5714	Nov 34.5714	Dec 34.5714	(38)
Heat transfer coeff	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	(39)
Average = Sum(39)m / 12 =												86.5599	(39)
HLP	Jan 0.9998	Feb 0.9998	Mar 0.9998	Apr 0.9998	May 0.9998	Jun 0.9998	Jul 0.9998	Aug 0.9998	Sep 0.9998	Oct 0.9998	Nov 0.9998	Dec 0.9998	(40)
HLP (average)												0.9998	(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	2.5760 (42)
Average daily hot water use (litres/day)	95.3790 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169	(44)
Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793	(45)
Energy content (annual)	Total = Sum(45)m =												1500.6825 (45)
Distribution loss (46)m = 0.15 x (45)m	23.3383	20.4118	21.0632	18.3634	17.6201	15.2048	14.0895	16.1679	16.3610	19.0672	20.8133	22.6019	(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	14.1300	12.7519	14.0844	13.5874	14.0093	13.5216	13.9501	13.9885	13.5575	14.0534	13.6458	14.1182	(61)
Total heat required for water heating calculated for each month	169.7186	148.8307	154.5056	136.0100	131.4767	114.8871	107.8800	121.7745	122.6308	141.1678	152.4012	164.7975	(62)
WWHRS	-47.8906	-42.1368	-43.0065	-35.3895	-32.8624	-27.1117	-22.9488	-27.7846	-28.5937	-35.3438	-40.9362	-46.2873	eq. (G10)
Total of WWHRS savings												-430.2918	
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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102	(64)
	Total per year (kWh/year) = Sum(64)m =												1235.7887 (64)
Heat gains from water heating, kWh/month	55.2657	48.4342	50.2111	44.1024	42.5602	37.0844	34.7192	39.3360	39.6562	45.7789	49.5476	53.6304	(65)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9399	0.9101	0.8530	0.7489	0.5019	0.4324	0.2948	0.3319	0.5516	0.7958	0.9107	0.7480 (94)
Useful gains	658.2271	728.5322	773.2245	760.2124	649.9862	457.5052	298.3183	313.8723	476.9984	602.7938	621.3420	629.8563 (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												
Month fract _i	1221.5377	1195.6062	1095.6243	927.8679	711.4157	471.3539	300.8153	317.7888	510.1089	777.8880	1021.7614	1222.2923 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

419.1031	313.8738	239.8655	120.7119	45.7035	0.0000	0.0000	0.0000	0.0000	130.2701	288.3020	440.7724 (98)
Space heating											1998.6021 (98)
Space heating per m2											(98) / (4) = 23.0839 (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	2208.4002 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	419.1031	313.8738	239.8655	120.7119	45.7035	0.0000	0.0000	0.0000	0.0000	130.2701	288.3020	440.7724	(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)	463.0973	346.8218	265.0447	133.3834	50.5011	0.0000	0.0000	0.0000	0.0000	143.9448	318.5657	487.0413	(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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102	(64)
Efficiency of water heater (217)m	89.7590	89.6662	89.4594	89.0166	88.2886	87.3000	87.3000	87.3000	87.3000	89.0371	89.5844	87.3000	(216)
Fuel for water heating, kWh/month	135.7280	118.9901	124.6365	113.0357	111.6953	100.5445	97.2866	107.6631	107.7172	118.8537	124.4245	131.9676	(219)
Water heating fuel used												1392.5430	(219)
Annual totals kWh/year													
Space heating fuel - main system												2208.4002	(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) 58.6472 (230a)
 central heating pump 30.0000 (230c)
 main heating flue fan 45.0000 (230e)
 Total electricity for the above, kWh/year 133.6472 (231)
 Electricity for lighting (calculated in Appendix L) 376.3269 (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 2383.6779 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2208.4002	3.4800	76.8523	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1392.5430	3.4800	48.4605	(247)
Mechanical ventilation fans	58.6472	13.1900	7.7356	(249)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	376.3269	13.1900	49.6375	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			84.7555	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	0.2705 (257)
SAP value	96.2260
SAP rating (Section 12)	96 (258)
SAP band	A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2208.4002	0.2160	477.0144	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1392.5430	0.2160	300.7893	(264)
Space and water heating			777.8037	(265)
Pumps and fans	133.6472	0.5190	69.3629	(267)
Energy for lighting	376.3269	0.5190	195.3137	(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	146.0431 (272)
CO2 emissions per m2	1.6900 (273)
EI value	98.5127
EI rating	99 (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	43.2900 (1b)	x 2.3100 (2b)	= 99.9999 (1b) - (3b)
First floor	43.2900 (1c)	x 2.5300 (2c)	= 109.5237 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.5800		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 209.5236 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Window (Uw = 1.20)			11.9500	1.1450	13.6832			(27)					
French Door (Uw = 1.40)			3.0900	1.3258	4.0966			(27)					
Front Door			2.1500	1.0000	2.1500			(26)					
FP McCann System			43.2900	0.1100	4.7619	75.0000	3246.7500	(28a)					
100mm Knauf Supafil 34	90.6000	17.1900	73.4100	0.2500	18.3525	52.8000	3876.0480	(29a)					
Plane Ceiling-500mm Loft Roll	43.2900		43.2900	0.0900	3.8961	9.0000	389.6100	(30)					
Total net area of external elements Aum(A, m2)			177.1800					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.9403			(33)					
E-WM-30			40.3600	0.0000	0.0000	45.0000	1816.2000	(32)					
1F Timber			101.1200			9.0000	910.0800	(32c)					
GF Timber			57.3800			9.0000	516.4200	(32c)					
GF Masonry			19.2700			39.0000	751.5300	(32c)					
Internal Floor			43.2900			12.6000	545.4540	(32d)					
Internal Ceiling			43.2900			9.0000	389.6100	(32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	12441.7020	(34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							143.7018	(35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.0482	(36)					
Total fabric heat loss						(33) + (36) =	51.9885	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 34.5714	Feb 34.5714	Mar 34.5714	Apr 34.5714	May 34.5714	Jun 34.5714	Jul 34.5714	Aug 34.5714	Sep 34.5714	Oct 34.5714	Nov 34.5714	Dec 34.5714	(38)
Heat transfer coeff	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	86.5599	(39)
Average = Sum(39)m / 12 =												86.5599	(39)
HLP	Jan 0.9998	Feb 0.9998	Mar 0.9998	Apr 0.9998	May 0.9998	Jun 0.9998	Jul 0.9998	Aug 0.9998	Sep 0.9998	Oct 0.9998	Nov 0.9998	Dec 0.9998	(40)
HLP (average)												0.9998	(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	2.5760 (42)
Average daily hot water use (litres/day)	95.3790 (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	104.9169	101.1017	97.2865	93.4714	89.6562	85.8411	85.8411	89.6562	93.4714	97.2865	101.1017	104.9169	(44)
Energy conte	155.5887	136.0788	140.4212	122.4226	117.4674	101.3654	93.9300	107.7860	109.0733	127.1144	138.7553	150.6793	(45)
Energy content (annual)	Total = Sum (45)m = 1500.6825												(45)
Distribution loss (46)m = 0.15 x (45)m	23.3383	20.4118	21.0632	18.3634	17.6201	15.2048	14.0895	16.1679	16.3610	19.0672	20.8133	22.6019	(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	14.1300	12.7519	14.0844	13.5874	14.0093	13.5216	13.9501	13.9885	13.5575	14.0534	13.6458	14.1182	(61)
Total heat required for water heating calculated for each month	169.7186	148.8307	154.5056	136.0100	131.4767	114.8871	107.8800	121.7745	122.6308	141.1678	152.4012	164.7975	(62)
WWHRS	-47.8906	-42.1368	-43.0065	-35.3895	-32.8624	-27.1117	-22.9488	-27.7846	-28.5937	-35.3438	-40.9362	-46.2873	eq. (G10)
Total of WWHRS savings	-430.2918												
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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102	(64)
Heat gains from water heating, kWh/month	55.2657	48.4342	50.2111	44.1024	42.5602	37.0844	34.7192	39.3360	39.6562	45.7789	49.5476	53.6304	(65)
Total per year (kWh/year) = Sum (64)m =	1235.7887												(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	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	154.5574	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	53.2730	47.3166	38.4804	29.1322	21.7766	18.3848	19.8654	25.8218	34.6579	44.0062	51.3617	54.7536	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	347.2288	350.8319	341.7521	322.4223	298.0218	275.0888	259.7681	256.1650	265.2448	284.5747	308.9751	331.9081	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	53.0317	(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)	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	-103.0383	(71)
Water heating gains (Table 5)	74.2819	72.0747	67.4881	61.2533	57.2046	51.5061	46.6656	52.8709	55.0781	61.5308	68.8161	72.0839	(72)
Total internal gains	582.3345	577.7740	555.2715	520.3585	484.5539	452.5305	433.8500	442.4085	462.5317	497.6624	536.7038	566.2964	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W			
East				5.9200	22.3313	0.4600	0.0000	0.7700	46.8257 (76)			
South				1.5400	50.9848	0.4600	0.0000	0.7700	27.8106 (78)			
West				4.4900	22.3313	0.4600	0.0000	0.7700	35.5148 (80)			
West				3.0900	22.3313	0.4300	0.0000	0.7700	22.8471 (80)			
Solar gains	132.9983	225.9682	351.9079	510.4669	598.0808	650.9939	614.7008	547.3321	436.6651	281.4024	168.1078	109.4816 (83)
Total gains	715.3327	803.7422	907.1793	1030.8255	1082.6346	1103.5244	1048.5507	989.7406	899.1967	779.0648	704.8116	675.7780 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264	39.9264		
alpha	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618	3.6618		
util living area	0.9541	0.9312	0.8744	0.7570	0.5884	0.3844	0.2546	0.2780	0.5271	0.8022	0.9241	0.9610	(86)	
MIT	19.8176	20.0038	20.3456	20.6925	20.9054	20.9853	20.9977	20.9968	20.9521	20.6784	20.1922	19.7612	(87)	
Th 2	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	20.0835	(88)	
util rest of house	0.9459	0.9194	0.8534	0.7203	0.5334	0.3169	0.1800	0.1993	0.4539	0.7617	0.9086	0.9538	(89)	
MIT 2	18.5351	18.7987	19.2755	19.7365	19.9945	20.0742	20.0828	20.0824	20.0472	19.7318	19.0713	18.4550	(90)	
Living area fraction	fLA = Living area / (4) =												0.1624	(91)
MIT	18.7434	18.9944	19.4493	19.8918	20.1424	20.2222	20.2314	20.2309	20.1942	19.8855	19.2533	18.6671	(92)	
Temperature adjustment	-0.1500													
adjusted MIT	18.5934	18.8444	19.2993	19.7418	19.9924	20.0722	20.0814	20.0809	20.0442	19.7355	19.1033	18.5171	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9283	0.8993	0.8323	0.7052	0.5277	0.3161	0.1798	0.1990	0.4506	0.7442	0.8880	0.9374	(94)
Useful gains	664.0790	722.8412	755.0725	726.9606	571.2636	348.7933	188.5282	197.0047	405.2106	579.7548	625.8426	633.4887	(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	1167.9833	1146.4342	1030.0021	851.9030	605.2623	352.4850	188.8190	197.4367	419.3093	704.2068	961.1039	1161.3862	(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 FOR IMPROVED DWELLING 09 Jan 2014

Space heating	374.9048	284.6545	204.5476	89.9585	25.2950	0.0000	0.0000	0.0000	0.0000	92.5923	241.3881	392.7558 (98)
Space heating per m2											(98) / (4) =	1706.0967 (98)
												19.7054 (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												1885.1898 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	374.9048	284.6545	204.5476	89.9585	25.2950	0.0000	0.0000	0.0000	0.0000	92.5923	241.3881	392.7558 (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)	414.2595	314.5353	226.0195	99.4017	27.9503	0.0000	0.0000	0.0000	0.0000	102.3119	266.7272	433.9843 (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	121.8281	106.6939	111.4991	100.6206	98.6143	87.7754	84.9312	93.9899	94.0371	105.8240	111.4650	118.5102 (64)
Efficiency of water heater	89.6937	89.6045	89.3446	88.7818	87.9347	87.3000	87.3000	87.3000	87.3000	88.7647	89.4641	87.3000 (216)
Fuel for water heating, kWh/month	135.8269	119.0719	124.7966	113.3347	112.1449	100.5445	97.2866	107.6631	107.7172	119.2186	124.5919	132.0631 (219)
Water heating fuel used												1394.2601 (219)
Annual totals kWh/year												
Space heating fuel - main system												1885.1898 (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)												58.6472 (230a)
central heating pump												30.0000 (230c)
main heating flue fan												45.0000 (230e)
Total electricity for the above, kWh/year												133.6472 (231)
Electricity for lighting (calculated in Appendix L)												376.3269 (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												1965.2644 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1885.1898	3.9200	73.8994 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1394.2601	3.9200	54.6550 (247)
Mechanical ventilation fans	58.6472	16.9600	9.9466 (249)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	376.3269	16.9600	63.8250 (250)
Additional standing charges			88.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	16.9600	-309.3775 (252)
Total energy cost			-6.3314 (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	1885.1898	0.2160	407.2010 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1394.2601	0.2160	301.1602 (264)
Space and water heating			708.3612 (265)
Pumps and fans	133.6472	0.5190	69.3629 (267)
Energy for lighting	376.3269	0.5190	195.3137 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			26.2989 (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	1885.1898	1.2200	2299.9315 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Water heating (other fuel)	1394.2601	1.2200	1700.9973 (264)
Space and water heating			4000.9288 (265)
Pumps and fans	133.6472	3.0700	410.2970 (267)
Energy for lighting	376.3269	3.0700	1155.3237 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-33.6206 (272)
Primary energy kWh/m2/year			-0.3883 (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	East
Overshading	Average or unknown
Thermal mass parameter	143.7 (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	276.57 (P1)
Transmission heat loss coefficient	51.99 (37)
Summer heat loss coefficient	328.56 (P2)

Overhangs

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

Solar shading

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	5.9200	117.5071	0.4600	0.0000	0.9000	287.9957
South	1.5400	112.2060	0.4600	0.0000	0.9000	71.5381
West	4.4900	117.5071	0.4600	0.0000	0.9000	218.4292
West	3.0900	117.5071	0.4300	0.0000	0.9000	140.5185
total:						718.4814

	Jun	Jul	Aug	
Solar gains	761	718	640	(P4)
Internal gains	450	431	439	
Total summer gains	1210	1149	1079	(P5)
Summer gain/loss ratio	3.68	3.50	3.28	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 143.7)	0.99	0.99	0.99	
Threshold temperature	20.68	22.39	22.00	(P7)
Likelihood of high internal temperature	Slight	Medium	Medium	
Assessment of likelihood of high internal temperature:	Medium			