

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	059 - PRJ013014			Issued on Date	27/01/2025
Assessment Reference	059	Prop Type Ref	D1		
Property	17 Erwood Close, Netley Abbey, Southampton, SO31 5TJ				
SAP Rating	85 B	DER	15.35	TER	18.41
Environmental	87 B	% DER<TER	16.63		
CO ₂ Emissions (t/year)	1.24	DFEE	51.73	TFEE	58.28
General Requirements Compliance	Pass	% DFEE<TFEE	11.24		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	U903-0001
Client					

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

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DWELLING AS BUILT

Detached House, total floor area 96 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.41 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.35 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)58.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	OK
Openings	1.38 (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: 4.06 (measured in this dwelling)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB)
Combi boiler
Efficiency: 89.3% 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

Not applicable

9 Summertime temperature

Overheating risk (Southern England): Slight OK

Based on:

Overshading: Average

Windows facing North: 1.53 m², No overhang

Windows facing East: 7.39 m², No overhang

Windows facing South: 3.06 m², No overhang

Windows facing West: 10.27 m², No overhang

Air change rate: 4.69 ach

Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Roof U-value 0.08 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3695 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3695 (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	0.4711	0.4619	0.4526	0.4064	0.3972	0.3510	0.3510	0.3418	0.3695	0.3972	0.4157	0.4341 (22b)
Effective ac	0.6110	0.6067	0.6024	0.5826	0.5789	0.5616	0.5616	0.5584	0.5683	0.5789	0.5864	0.5942 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			22.2600	1.3258	29.4981		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	141.0010	24.2950	116.7060	0.2100	24.5083	7.4000	863.6244 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2940				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.9731		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6132.9357 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.6857 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9047 (36)
Total fabric heat loss						(33) + (36) =	88.8778 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.4423	48.1007	47.7658	46.1929	45.8986	44.5287	44.5287	44.2750	45.0564	45.8986	46.4940	47.1163 (38)
Heat transfer coeff	137.3201	136.9785	136.6436	135.0707	134.7764	133.4065	133.4065	133.1528	133.9342	134.7764	135.3718	135.9942 (39)
Average = Sum(39)m / 12 =												135.0693 (39)
HLP	1.4260	1.4224	1.4189	1.4026	1.3995	1.3853	1.3853	1.3827	1.3908	1.3995	1.4057	1.4122 (40)
HLP (average)												1.4026 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (46)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495	(61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(62)
WWHRS	-52.9687	-46.6059	-47.5672	-39.1354	-36.3372	-29.9758	-25.3685	-30.7157	-31.6123	-39.0801	-45.2705	-51.1970	eq. (G10)
Total of WWHRS savings												-475.8342	
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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424	(65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)													
Total per year (kWh/year) = Sum(64)m = 1078.7427 (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	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3058	19.8119	16.1121	12.1979	9.1181	7.6978	8.3178	10.8118	14.5116	18.4258	21.5056	22.9258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.2037	252.8000	246.2573	232.3288	214.7465	198.2216	187.1819	184.5856	191.1282	205.0568	222.6391	239.1640	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806	(72)
Total internal gains	410.9984	408.8291	393.8595	369.5722	344.7238	320.8886	305.4686	311.7796	324.3056	348.8176	376.9958	398.3084	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.5320	10.6334	0.7300	0.7200	0.7700		5.9336 (74)	
East					7.3910	19.6403	0.7300	0.7200	0.7700		52.8736 (76)	
South					3.0640	46.7521	0.7300	0.7200	0.7700		52.1769 (78)	
West					10.2710	19.6403	0.7300	0.7200	0.7700		73.4765 (80)	

Solar gains	184.4607	343.9594	535.1696	747.6336	897.4430	912.7855	871.2741	759.1969	610.2907	398.9517	226.7111	153.9364 (83)
Total gains	595.4591	752.7886	929.0291	1117.2058	1242.1668	1233.6741	1176.7427	1070.9765	934.5963	747.7693	603.7069	552.2448 (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	12.4060	12.4369	12.4674	12.6126	12.6401	12.7699	12.7699	12.7943	12.7196	12.6401	12.5846	12.5270	
alpha	1.8271	1.8291	1.8312	1.8408	1.8427	1.8513	1.8513	1.8530	1.8480	1.8427	1.8390	1.8351	
util living area	0.9356	0.9032	0.8497	0.7622	0.6511	0.5262	0.4188	0.4628	0.6452	0.8239	0.9126	0.9430	(86)
MIT	17.3580	17.7950	18.4919	19.3411	20.0565	20.5630	20.7990	20.7502	20.3159	19.3330	18.1837	17.2774	(87)
Th 2	19.7435	19.7462	19.7488	19.7613	19.7637	19.7746	19.7746	19.7766	19.7704	19.7637	19.7589	19.7540	(88)
util rest of house	0.9274	0.8912	0.8309	0.7320	0.6042	0.4556	0.3232	0.3666	0.5800	0.7940	0.8997	0.9357	(89)
MIT 2	15.0326	15.6462	16.6194	17.7890	18.7408	19.3816	19.6422	19.6017	19.1064	17.8128	16.2089	14.9209	(90)
Living area fraction	15.4899	16.0689	16.9877	18.0943	18.9996	19.6140	19.8697	19.8276	19.3443	18.1118	16.5973	15.3844	(92)
MIT	15.4899	16.0689	16.9877	18.0943	18.9996	19.6140	19.8697	19.8276	19.3443	18.1118	16.5973	15.3844	(92)
Temperature adjustment												-0.1500	
adjusted MIT	15.3399	15.9189	16.8377	17.9443	18.8496	19.4640	19.7197	19.6776	19.1943	17.9618	16.4473	15.2344	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8814	0.8368	0.7712	0.6765	0.5638	0.4356	0.3185	0.3579	0.5439	0.7352	0.8472	0.8928	(94)
Ext temp.	524.8638	629.9089	716.4899	755.8361	700.3641	537.4164	374.7824	383.3246	508.3043	549.7598	511.4716	493.0279	(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	1516.0017	1509.3459	1412.5842	1221.6168	963.5914	648.8867	416.1915	436.4231	682.2949	992.1928	1265.3577	1500.6141	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	737.4066	590.9817	517.8942	335.3621	195.8411	0.0000	0.0000	0.0000	0.0000	329.1701	542.7980	749.6442	(98)
												3999.0980	(98)
												41.5275	(99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4433.5898	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	737.4066	590.9817	517.8942	335.3621	195.8411	0.0000	0.0000	0.0000	0.0000	329.1701	542.7980	749.6442	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	817.5240	655.1903	574.1621	371.7983	217.1187	0.0000	0.0000	0.0000	0.0000	364.9336	601.7716	831.0911	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)	
Efficiency of water heater (217)m	88.1624	88.0110	87.6814	86.9446	85.5122	76.4000	76.4000	76.4000	76.4000	86.7585	87.7655	76.4000	(216)	
Fuel for water heating, kWh/month	122.7219	107.2260	111.6892	100.8615	99.7949	98.1690	94.1205	105.9296	106.5275	106.7676	112.2068	118.8539	(219)	
Water heating fuel used												1284.8683	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4433.5898	(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)													393.9281	(232)
Total delivered energy for all uses													6187.3862	(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	4433.5898	0.2160	957.6554 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1284.8683	0.2160	277.5316 (264)
Space and water heating			1235.1869 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.9281	0.5190	204.4487 (268)
Total CO2, kg/year			1478.5606 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.3500 (273)

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

DER		15.3500	ZC1
Total Floor Area	TFA	96.3000	
Assumed number of occupants	N	2.7025	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.3962	ZC2
CO2 emissions from cooking, equation (L16)		1.9093	ZC3
Total CO2 emissions		32.6555	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		32.6555	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1249 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3749 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3749 (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	0.4779	0.4686	0.4592	0.4123	0.4030	0.3561	0.3561	0.3467	0.3749	0.4030	0.4217	0.4405 (22b)
Effective ac	0.6142	0.6098	0.6054	0.5850	0.5812	0.5634	0.5634	0.5601	0.5703	0.5812	0.5889	0.5970 (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			2.0400	1.0000	2.0400		(26)					
TER Opening Type (Uw = 1.40)			22.0400	1.3258	29.2197		(27)					
Flr - Ground			48.1490	0.1300	6.2594		(28a)					
Wl - Brick (Timber Frame)	141.0010	24.0770	116.9240	0.1800	21.0463		(29a)					
Rf - Ins Joist	48.1490		48.1490	0.1300	6.2594		(30)					
Total net area of external elements Aum(A, m2)			237.3020				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26) ... (30) + (32) =		64.8248		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5988 (36)					
Total fabric heat loss						(33) + (36) =	76.4236 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.7004	48.3487	48.0040	46.3850	46.0821	44.6720	44.6720	44.4108	45.2151	46.0821	46.6949	47.3355 (38)
Heat transfer coeff	125.1239	124.7723	124.4276	122.8086	122.5056	121.0955	121.0955	120.8344	121.6387	122.5056	123.1184	123.7591 (39)
Average = Sum(39)m / 12 =												122.8071 (39)
HLP	Jan 1.2993	Feb 1.2957	Mar 1.2921	Apr 1.2753	May 1.2721	Jun 1.2575	Jul 1.2575	Aug 1.2548	Sep 1.2631	Oct 1.2721	Nov 1.2785	Dec 1.2851 (40)
HLP (average)												1.2753 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (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												

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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	50.9589	47.5483	47.1278	43.6668	45.1224	47.1278	47.5483	50.9589	49.3151	50.9589 (61)
Solar input	211.4515	186.3952	195.8059	173.8295	168.2976	148.2271	142.0129	158.3111	160.0594	182.0798	192.4437	206.3874 (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	211.4515	186.3952	195.8059	173.8295	168.2976	148.2271	142.0129	158.3111	160.0594	182.0798	192.4437	206.3874 (64)
Heat gains from water heating, kWh/month	66.1035	58.1791	60.9014	53.8756	52.0709	45.6830	43.4967	48.7504	49.2970	56.3374	59.9191	64.4197 (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	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3058	19.8119	16.1121	12.1979	9.1181	7.6978	8.3178	10.8118	14.5116	18.4258	21.5056	22.9258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.2037	252.8000	246.2573	232.3288	214.7465	198.2216	187.1819	184.5856	191.1282	205.0568	222.6391	239.1640	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	88.8488	86.5761	81.8567	74.8272	69.9878	63.4486	58.4633	65.5247	68.4681	75.7223	83.2209	86.5856	(72)
Total internal gains	427.8963	425.7260	410.7641	385.8918	360.3903	335.9060	320.5010	327.4601	340.6459	365.7429	393.9036	415.2134	(73)

6. Solar gains

[Jan]	Area m2				Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North	1.5200				10.6334	0.6300	0.7000	0.7700		4.9395 (74)		
East	7.3200				19.6403	0.6300	0.7000	0.7700		43.9370 (76)		
South	3.0300				46.7521	0.6300	0.7000	0.7700		43.2928 (78)		
West	10.1700				19.6403	0.6300	0.7000	0.7700		61.0436 (80)		
Solar gains	153.2129	285.7064	444.5632	621.0958	745.5792	758.3370	723.8449	630.7135	506.9798	331.3937	188.3087	127.8577 (83)
Total gains	581.1092	711.4324	855.3273	1006.9876	1105.9695	1094.2430	1044.3459	958.1736	847.6257	697.1365	582.2123	543.0711 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.4470	53.5976	53.7461	54.4547	54.5893	55.2250	55.2250	55.3443	54.9784	54.5893	54.3176	54.0364	
alpha	4.5631	4.5732	4.5831	4.6303	4.6393	4.6817	4.6817	4.6896	4.6652	4.6393	4.6212	4.6024	
util living area	0.9979	0.9944	0.9825	0.9401	0.8347	0.6604	0.4993	0.5603	0.8194	0.9714	0.9955	0.9985	(86)
MIT	19.5667	19.7636	20.0838	20.4858	20.7937	20.9499	20.9891	20.9818	20.8617	20.4306	19.9215	19.5371	(87)
Th 2	19.8414	19.8442	19.8470	19.8603	19.8627	19.8743	19.8743	19.8764	19.8698	19.8627	19.8577	19.8525	(88)
util rest of house	0.9972	0.9924	0.9762	0.9184	0.7789	0.5632	0.3771	0.4332	0.7381	0.9570	0.9936	0.9979	(89)
MIT 2	17.9431	18.2321	18.6973	19.2720	19.6691	19.8429	19.8706	19.8695	19.7632	19.2094	18.4728	17.9075	(90)
Living area fraction	18.2624	18.5333	18.9700	19.5107	19.8903	20.0606	20.0906	20.0882	19.9792	19.4496	18.7577	18.2280	(92)
Temperature adjustment	18.2624	18.5333	18.9700	19.5107	19.8903	20.0606	20.0906	20.0882	19.9792	19.4496	18.7577	18.2280	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9956	0.9891	0.9696	0.9100	0.7804	0.5803	0.4012	0.4582	0.7472	0.9498	0.9908	0.9967	(94)
Ext temp.	578.5494	703.6890	829.3479	916.4047	863.1194	634.9991	419.0246	438.9984	633.3192	662.1509	576.8293	541.2942	(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	1747.0282	1701.0591	1551.6125	1303.0853	1003.3593	661.2536	422.6909	445.6646	715.1421	1084.1232	1435.2826	1736.0935	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m2	869.3482	670.2327	537.3649	278.4101	104.3385	0.0000	0.0000	0.0000	0.0000	313.9474	618.0864	888.9306	(98)
												4280.6589	(98)
												44.4513	(99)

8c. Space cooling requirement

Not applicable

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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													4583.1465 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	869.3482	670.2327	537.3649	278.4101	104.3385	0.0000	0.0000	0.0000	0.0000	313.9474	618.0864	888.9306	(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)	930.7797	717.5939	575.3372	298.0836	111.7114	0.0000	0.0000	0.0000	0.0000	336.1321	661.7628	951.7458	(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	211.4515	186.3952	195.8059	173.8295	168.2976	148.2271	142.0129	158.3111	160.0594	182.0798	192.4437	206.3874	(64)
Efficiency of water heater (217)m	88.2289	87.9918	87.4620	86.2311	83.8868	80.3000	80.3000	80.3000	80.3000	86.4104	87.7786	88.3071	(216)
Fuel for water heating, kWh/month	239.6624	211.8325	223.8753	201.5856	200.6246	184.5917	176.8529	197.1495	199.3268	210.7151	219.2376	233.7154	(219)
Water heating fuel used												2499.1695	(219)
Annual totals kWh/year													
Space heating fuel - main system												4583.1465	(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)												393.9281	(232)
Total delivered energy for all uses												7551.2442	(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	4583.1465	0.2160	989.9597 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2499.1695	0.2160	539.8206 (264)
Space and water heating			1529.7803 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.9281	0.5190	204.4487 (268)
Total CO2, kg/m2/year			1773.1540 (272)
Emissions per m2 for space and water heating			15.8856 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1230 (272b)
Emissions per m2 for pumps and fans			0.4042 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8856 * 1.00) + 2.1230 + 0.4042, rounded to 2 d.p.			18.4100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (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) = 0.1249 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3279 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3279 (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	0.4180	0.4098	0.4016	0.3606	0.3524	0.3115	0.3115	0.3033	0.3279	0.3524	0.3688	0.3852 (22b)
Effective ac	0.5874	0.5840	0.5807	0.5650	0.5621	0.5485	0.5485	0.5460	0.5537	0.5621	0.5680	0.5742 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			22.2600	1.3258	29.4981		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	141.0010	24.2950	116.7060	0.2100	24.5083	7.4000	863.6244 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2940				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.9731		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6132.9357 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.6857 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9047 (36)
Total fabric heat loss						(33) + (36) =	88.8778 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	46.5718	46.3028	46.0392	44.8007	44.5690	43.4903	43.4903	43.2905	43.9058	44.5690	45.0377	45.5278 (38)
Heat transfer coeff	135.4496	135.1806	134.9170	133.6785	133.4468	132.3681	132.3681	132.1683	132.7836	133.4468	133.9155	134.4056 (39)
Average = Sum(39)m / 12 =												133.6774 (39)
HLP	1.4065	1.4037	1.4010	1.3881	1.3857	1.3745	1.3745	1.3725	1.3789	1.3857	1.3906	1.3957 (40)
HLP (average)												1.3881 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	(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	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month	34.1047	29.8282	30.7800	26.8347	25.7486	22.2191	20.5892	23.6264	23.9086	27.8632	30.4148	33.0286 (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	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3058	19.8119	16.1121	12.1979	9.1181	7.6978	8.3178	10.8118	14.5116	18.4258	21.5056	22.9258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.2037	252.8000	246.2573	232.3288	214.7465	198.2216	187.1819	184.5856	191.1282	205.0568	222.6391	239.1640	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	45.8396	44.3871	41.3710	37.2705	34.6083	30.8598	27.6737	31.7560	33.2064	37.4505	42.2428	44.3932	(72)
Total internal gains	381.8871	380.5370	367.2784	345.3351	322.0108	300.3172	286.7114	290.6913	302.3842	324.4711	349.9255	370.0210	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.5320	10.6334	0.7300	0.7200	0.7700		5.9336 (74)	
East					7.3910	19.6403	0.7300	0.7200	0.7700		52.8736 (76)	
South					3.0640	46.7521	0.7300	0.7200	0.7700		52.1769 (78)	
West					10.2710	19.6403	0.7300	0.7200	0.7700		73.4765 (80)	
Solar gains	184.4607	343.9594	535.1696	747.6336	897.4430	912.7855	871.2741	759.1969	610.2907	398.9517	226.7111	153.9364 (83)
Total gains	566.3478	724.4964	902.4479	1092.9687	1219.4538	1213.1027	1157.9855	1049.8882	912.6749	723.4228	576.6366	523.9574 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	12.5773	12.6023	12.6270	12.7440	12.7661	12.8701	12.8701	12.8896	12.8298	12.7661	12.7214	12.6750	
alpha	1.8385	1.8402	1.8418	1.8496	1.8511	1.8580	1.8580	1.8593	1.8553	1.8511	1.8481	1.8450	
util living area	0.9401	0.9078	0.8543	0.7665	0.6549	0.5298	0.4219	0.4674	0.6510	0.8302	0.9179	0.9473	(86)
MIT	17.3409	17.7831	18.4862	19.3371	20.0555	20.5615	20.7985	20.7482	20.3104	19.3192	18.1621	17.2553	(87)
Th 2	19.7583	19.7605	19.7626	19.7724	19.7743	19.7829	19.7829	19.7845	19.7796	19.7743	19.7705	19.7666	(88)
util rest of house	0.9324	0.8964	0.8361	0.7368	0.6085	0.4595	0.3264	0.3712	0.5865	0.8011	0.9058	0.9406	(89)
MIT 2	16.4459	16.8810	17.5680	18.3901	19.0580	19.5070	19.6899	19.6609	19.3108	18.3979	17.2685	16.3668	(90)
Living area fraction									fLA = Living area / (4) =			0.1967	(91)
MIT	16.6219	17.0584	17.7486	18.5764	19.2542	19.7144	19.9079	19.8747	19.5074	18.5791	17.4442	16.5416	(92)
Temperature adjustment												0.0000	
adjusted MIT	16.6219	17.0584	17.7486	18.5764	19.2542	19.7144	19.9079	19.8747	19.5074	18.5791	17.4442	16.5416	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9050	0.8627	0.7983	0.7022	0.5862	0.4552	0.3370	0.3790	0.5699	0.7653	0.8741	0.9152	(94)
Ext temp.	512.5429	625.0539	720.4642	767.4990	714.7830	552.2040	390.2062	397.9511	520.1293	553.6146	504.0212	479.5244	(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	1668.9939	1643.5836	1517.6223	1293.5240	1008.0853	676.9850	437.8613	459.2486	718.0164	1064.7792	1385.2543	1658.7777	(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	860.3996	684.4520	593.0856	378.7380	218.2170	0.0000	0.0000	0.0000	0.0000	380.3065	634.4878	877.3645	(98)
Space heating per m2												4627.0510	(98)
										(98) / (4) =		48.0483	(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	1244.2599	979.5238	1004.4792	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7131	0.7685	0.7368	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	887.2661	752.7908	740.0506	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1520.8181	1454.1848	1329.6277	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												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	456.1574	521.8371	438.6453	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												1416.6399 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	114.0393	130.4593	109.6613	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												354.1600 (107)
Space cooling per m2												3.6777 (108)
Energy for space heating												48.0483 (99)
Energy for space cooling												3.6777 (108)
Total												51.7260 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1249 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3749 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3749 (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	0.4779	0.4686	0.4592	0.4123	0.4030	0.3561	0.3561	0.3467	0.3749	0.4030	0.4217	0.4405 (22b)
Effective ac	0.6142	0.6098	0.6054	0.5850	0.5812	0.5634	0.5634	0.5601	0.5703	0.5812	0.5889	0.5970 (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			2.0400	1.0000	2.0400		(26)					
TER Opening Type (Uw = 1.40)			22.0400	1.3258	29.2197		(27)					
Flr - Ground			48.1490	0.1300	6.2594		(28a)					
Wl - Brick (Timber Frame)	141.0010	24.0770	116.9240	0.1800	21.0463		(29a)					
Rf - Ins Joist	48.1490		48.1490	0.1300	6.2594		(30)					
Total net area of external elements Aum(A, m2)			237.3020				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.8248		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.5988 (36)					
Total fabric heat loss						(33) + (36) =	76.4236 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 48.7004	Feb 48.3487	Mar 48.0040	Apr 46.3850	May 46.0821	Jun 44.6720	Jul 44.6720	Aug 44.4108	Sep 45.2151	Oct 46.0821	Nov 46.6949	Dec 47.3355 (38)
Heat transfer coeff	125.1239	124.7723	124.4276	122.8086	122.5056	121.0955	121.0955	120.8344	121.6387	122.5056	123.1184	123.7591 (39)
Average = Sum(39)m / 12 =												122.8071 (39)
HLP	Jan 1.2993	Feb 1.2957	Mar 1.2921	Apr 1.2753	May 1.2721	Jun 1.2575	Jul 1.2575	Aug 1.2548	Sep 1.2631	Oct 1.2721	Nov 1.2785	Dec 1.2851 (40)
HLP (average)												1.2753 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	Jan 108.2237	Feb 104.2883	Mar 100.3528	Apr 96.4174	May 92.4820	Jun 88.5466	Jul 88.5466	Aug 92.4820	Sep 96.4174	Oct 100.3528	Nov 104.2883	Dec 108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)												Total = Sum(45)m = 1547.9814 (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	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 Built)

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)
	34.1047	29.8282	30.7800	26.8347	25.7486	22.2191	20.5892	23.6264	23.9086	27.8632	30.4148	33.0286 (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	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	135.1266	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.3058	19.8119	16.1121	12.1979	9.1181	7.6978	8.3178	10.8118	14.5116	18.4258	21.5056	22.9258	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	250.2037	252.8000	246.2573	232.3288	214.7465	198.2216	187.1819	184.5856	191.1282	205.0568	222.6391	239.1640	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	36.5127	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	45.8396	44.3871	41.3710	37.2705	34.6083	30.8598	27.6737	31.7560	33.2064	37.4505	42.2428	44.3932	(72)
Total internal gains	381.8871	380.5370	367.2784	345.3351	322.0108	300.3172	286.7114	290.6913	302.3842	324.4711	349.9255	370.0210	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.5200	10.6334	0.6300	0.7000	0.7700	4.9395 (74)
East	7.3200	19.6403	0.6300	0.7000	0.7700	43.9370 (76)
South	3.0300	46.7521	0.6300	0.7000	0.7700	43.2928 (78)
West	10.1700	19.6403	0.6300	0.7000	0.7700	61.0436 (80)

Solar gains	153.2129	285.7064	444.5632	621.0958	745.5792	758.3370	723.8449	630.7135	506.9798	331.3937	188.3087	127.8577	(83)
Total gains	535.1000	666.2434	811.8415	966.4309	1067.5900	1058.6542	1010.5563	921.4048	809.3640	655.8647	538.2342	497.8787	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	53.4470	53.5976	53.7461	54.4547	54.5893	55.2250	55.2250	55.3443	54.9784	54.5893	54.3176	54.0364	
alpha	4.5631	4.5732	4.5831	4.6303	4.6393	4.6817	4.6817	4.6896	4.6652	4.6393	4.6212	4.6024	
util living area	0.9985	0.9957	0.9857	0.9477	0.8483	0.6772	0.5145	0.5795	0.8381	0.9772	0.9967	0.9989	(86)
MIT	19.5234	19.7218	20.0456	20.4564	20.7771	20.9444	20.9876	20.9791	20.8462	20.3959	19.8804	19.4944	(87)
Th 2	19.8414	19.8442	19.8470	19.8603	19.8627	19.8743	19.8743	19.8764	19.8698	19.8627	19.8577	19.8525	(88)
util rest of house	0.9980	0.9942	0.9804	0.9280	0.7947	0.5795	0.3894	0.4496	0.7602	0.9652	0.9953	0.9986	(89)
MIT 2	18.5021	18.7020	19.0249	19.4320	19.7182	19.8502	19.8714	19.8709	19.7871	19.3841	18.8714	18.4819	(90)
Living area fraction													(91)
MIT	18.7030	18.9026	19.2257	19.6335	19.9264	20.0654	20.0909	20.0888	19.9954	19.5831	19.0699	18.6810	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7030	18.9026	19.2257	19.6335	19.9264	20.0654	20.0909	20.0888	19.9954	19.5831	19.0699	18.6810	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	533.6225	661.2043	792.8684	892.2351	852.1110	632.2738	418.5493	437.9758	623.4491	630.4807	534.9713	496.8879	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1802.1596	1747.1353	1583.4231	1318.1637	1007.7857	661.8342	422.7360	445.7382	717.1118	1100.4845	1473.7127	1792.1605	(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	943.7916	729.7456	588.1726	306.6686	115.8220	0.0000	0.0000	0.0000	0.0000	349.6828	675.8938	963.6828	(98)
Space heating												4673.4599	(98)
Space heating per m2												48.5302	(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	1138.2980	896.1069	918.3414	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8840	0.9352	0.9098	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1006.2544	838.0579	835.5191	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1340.2938	1281.8650	1179.4523	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	240.5084	330.1925	255.8863	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												826.5872 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	60.1271	82.5481	63.9716	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												206.6468 (107)
Space cooling per m2												2.1459 (108)
Energy for space heating												48.5302 (99)
Energy for space cooling												2.1459 (108)
Total												50.6761 (109)
Target Fabric Energy Efficiency (TFEE)												58.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3695 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3695 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4526	0.4249	0.4157	0.3880	0.3880	0.3787	0.3787	0.3695	0.3695	0.3972	0.3972	0.4064 (22b)
Effective ac	0.6024	0.5903	0.5864	0.5753	0.5753	0.5717	0.5717	0.5683	0.5683	0.5789	0.5789	0.5826 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			22.2600	1.3258	29.4981		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	141.0010	24.2950	116.7060	0.2100	24.5083	7.4000	863.6244 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2940				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.9731		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6132.9357 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.6857 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9047 (36)
Total fabric heat loss						(33) + (36) =	88.8778 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	47.7658	46.8018	46.4940	45.6111	45.6111	45.3304	45.3304	45.0564	45.0564	45.8986	45.8986	46.1929 (38)
Heat transfer coeff	136.6436	135.6796	135.3718	134.4889	134.4889	134.2082	134.2082	133.9342	133.9342	134.7764	134.7764	135.0707 (39)
Average = Sum(39)m / 12 =												134.7984 (39)
HLP	1.4189	1.4089	1.4057	1.3966	1.3966	1.3936	1.3936	1.3908	1.3908	1.3995	1.3995	1.4026 (40)
HLP (average)												1.3998 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495	(61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Output from w/h	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424	(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	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7646	49.5296	40.2802	30.4947	22.7951	19.2446	20.7945	27.0295	36.2789	46.0644	53.7640	57.3145	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.4383	377.3135	367.5483	346.7594	320.5171	295.8531	279.3760	275.5009	285.2660	306.0549	332.2972	356.9613	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806	(72)
Total internal gains	612.1222	607.4907	583.7490	546.7300	508.6019	474.4973	454.5698	463.3429	484.6411	521.8848	563.3427	594.9247	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					1.5320	13.4684	0.7300	0.7200	0.7700	7.5156 (74)		
East					7.3910	25.1733	0.7300	0.7200	0.7700	67.7690 (76)		
South					3.0640	56.5862	0.7300	0.7200	0.7700	63.1521 (78)		
West					10.2710	25.1733	0.7300	0.7200	0.7700	94.1761 (80)		
Solar gains	232.6128	369.5738	585.5213	825.1655	934.7899	1050.2613	968.7291	878.5506	703.9148	468.5206	285.0689	190.7473 (83)
Total gains	844.7350	977.0646	1169.2703	1371.8955	1443.3918	1524.7586	1423.2989	1341.8935	1188.5558	990.4053	848.4116	785.6720 (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	12.4674	12.5560	12.5846	12.6672	12.6672	12.6937	12.6937	12.7196	12.7196	12.6401	12.6401	12.6126		
alpha	1.8312	1.8371	1.8390	1.8445	1.8445	1.8462	1.8462	1.8480	1.8480	1.8427	1.8427	1.8408		
util living area	0.8772	0.8443	0.7756	0.6697	0.5463	0.3861	0.2854	0.2920	0.4889	0.7014	0.8313	0.8873	(86)	
MIT	18.1601	18.4710	19.1090	19.8374	20.4180	20.7962	20.9220	20.9216	20.6687	19.9859	19.0074	18.1264	(87)	
Th 2	19.7488	19.7565	19.7589	19.7660	19.7660	19.7682	19.7682	19.7704	19.7704	19.7637	19.7637	19.7613	(88)	
util rest of house	0.8619	0.8258	0.7491	0.6309	0.4893	0.3083	0.1873	0.1888	0.4074	0.6532	0.8069	0.8730	(89)	
MIT 2	16.1578	16.5887	17.4644	18.4423	19.1866	19.6183	19.7346	19.7380	19.5024	18.6717	17.3512	16.1167	(90)	
Living area fraction									fLA = Living area / (4) =			0.1967	(91)	
MIT	16.5516	16.9589	17.7879	18.7167	19.4288	19.8500	19.9681	19.9708	19.7318	18.9302	17.6770	16.5120	(92)	
Temperature adjustment												-0.1500		
adjusted MIT	16.4016	16.8089	17.6379	18.5667	19.2788	19.7000	19.8181	19.8208	19.5818	18.7802	17.5270	16.3620	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	679.0969	748.5542	809.3201	804.9983	670.2122	462.9732	272.5209	259.3214	467.7597	601.0228	634.3174	641.4642	(94)	
Ext temp.	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000	(96)	
Heat loss rate W	1462.3104	1452.9778	1345.3077	1138.6739	830.9747	509.9897	284.2655	270.6516	546.6924	873.3792	1176.1873	1426.6173	(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	582.7109	473.3727	398.7748	240.2464	119.6073	0.0000	0.0000	0.0000	0.0000	202.6331	390.1463	584.1539	(98)	
Space heating												2991.6454	(98)	
RHI space heating demand												2992	(98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3695 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3695 (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	0.4711	0.4619	0.4526	0.4064	0.3972	0.3510	0.3510	0.3418	0.3695	0.3972	0.4157	0.4341 (22b)
Effective ac	0.6110	0.6067	0.6024	0.5826	0.5789	0.5616	0.5616	0.5584	0.5683	0.5789	0.5864	0.5942 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			22.2600	1.3258	29.4981		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	141.0010	24.2950	116.7060	0.2100	24.5083	7.4000	863.6244 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2940				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.9731		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6132.9357 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.6857 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9047 (36)
Total fabric heat loss						(33) + (36) =	88.8778 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	48.4423	48.1007	47.7658	46.1929	45.8986	44.5287	44.5287	44.2750	45.0564	45.8986	46.4940	47.1163 (38)
Heat transfer coeff	137.3201	136.9785	136.6436	135.0707	134.7764	133.4065	133.4065	133.1528	133.9342	134.7764	135.3718	135.9942 (39)
Average = Sum(39)m / 12 =												135.0693 (39)
HLP	1.4260	1.4224	1.4189	1.4026	1.3995	1.3853	1.3853	1.3827	1.3908	1.3995	1.4057	1.4122 (40)
HLP (average)												1.4026 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495	(61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(62)
WWHRS	-52.9687	-46.6059	-47.5672	-39.1354	-36.3372	-29.9758	-25.3685	-30.7157	-31.6123	-39.0801	-45.2705	-51.1970	eq. (G10)
Total of WWHRS savings												-475.8342	
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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424	(65)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)
Total per year (kWh/year) = Sum(64)m =													1078.7427 (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	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7646	49.5296	40.2802	30.4947	22.7951	19.2446	20.7945	27.0295	36.2789	46.0644	53.7640	57.3145	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.4383	377.3135	367.5483	346.7594	320.5171	295.8531	279.3760	275.5009	285.2660	306.0549	332.2972	356.9613	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806	(72)
Total internal gains	612.1222	607.4907	583.7490	546.7300	508.6019	474.4973	454.5698	463.3429	484.6411	521.8848	563.3427	594.9247	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.5320	10.6334	0.7300	0.7200	0.7700	5.9336 (74)
East	7.3910	19.6403	0.7300	0.7200	0.7700	52.8736 (76)
South	3.0640	46.7521	0.7300	0.7200	0.7700	52.1769 (78)
West	10.2710	19.6403	0.7300	0.7200	0.7700	73.4765 (80)

Solar gains	184.4607	343.9594	535.1696	747.6336	897.4430	912.7855	871.2741	759.1969	610.2907	398.9517	226.7111	153.9364	(83)
Total gains	796.5829	951.4502	1118.9185	1294.3636	1406.0449	1387.2828	1325.8438	1222.5399	1094.9318	920.8365	790.0537	748.8611	(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	12.4060	12.4369	12.4674	12.6126	12.6401	12.7699	12.7699	12.7943	12.7196	12.6401	12.5846	12.5270	
alpha	1.8271	1.8291	1.8312	1.8408	1.8427	1.8513	1.8513	1.8530	1.8480	1.8427	1.8390	1.8351	
util living area	0.9004	0.8653	0.8093	0.7205	0.6105	0.4869	0.3822	0.4203	0.5928	0.7731	0.8714	0.9094	(86)
MIT	17.6940	18.0964	18.7363	19.5128	20.1616	20.6191	20.8287	20.7891	20.4140	19.5362	18.4748	17.6156	(87)
Th 2	19.7435	19.7462	19.7488	19.7613	19.7637	19.7746	19.7746	19.7766	19.7704	19.7637	19.7589	19.7540	(88)
util rest of house	0.8887	0.8499	0.7873	0.6878	0.5626	0.4181	0.2921	0.3291	0.5266	0.7383	0.8540	0.8986	(89)
MIT 2	15.5001	16.0606	16.9477	18.0092	18.8640	19.4366	19.6636	19.6317	19.2118	18.0747	16.6079	15.3931	(90)
Living area fraction									fLA = Living area / (4) =			0.1967	(91)
MIT	15.9316	16.4610	17.2995	18.3049	19.1192	19.6692	19.8927	19.8593	19.4482	18.3622	16.9751	15.8302	(92)
Temperature adjustment												-0.1500	
adjusted MIT	15.7816	16.3110	17.1495	18.1549	18.9692	19.5192	19.7427	19.7093	19.2982	18.2122	16.8251	15.6802	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	664.1511	752.4338	814.3911	824.0638	741.8943	558.1492	383.9146	395.6571	544.6762	628.6144	628.6510	633.2672	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1576.6590	1563.0640	1455.1881	1250.0641	979.7197	656.2488	419.2595	440.6440	696.2189	1025.9389	1316.5002	1561.2393	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	678.9058	544.7435	476.7530	306.7202	176.9421	0.0000	0.0000	0.0000	0.0000	295.6094	495.2515	690.4112	(98)
Space heating												3665.3368	(98)
Space heating per m2												38.0616	(99)
(98) / (4) =													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.2000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4063.5663	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	678.9058	544.7435	476.7530	306.7202	176.9421	0.0000	0.0000	0.0000	0.0000	295.6094	495.2515	690.4112	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	752.6672	603.9285	528.5510	340.0446	196.1664	0.0000	0.0000	0.0000	0.0000	327.7267	549.0593	765.4227	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Efficiency of water heater	88.0147	87.8567	87.5065	86.7174	85.1932	76.4000	76.4000	76.4000	76.4000	86.4733	87.5762	88.1014	(216)
(217)m	88.0147	87.8567	87.5065	86.7174	85.1932	76.4000	76.4000	76.4000	76.4000	86.4733	87.5762	88.1014	(217)
Fuel for water heating, kWh/month	122.9279	107.4142	111.9125	101.1259	100.1686	98.1690	94.1205	105.9296	106.5275	107.1198	112.4493	119.0459	(219)
Water heating fuel used	122.9279	107.4142	111.9125	101.1259	100.1686	98.1690	94.1205	105.9296	106.5275	107.1198	112.4493	1286.9106	(219)
Annual totals kWh/year													
Space heating fuel - main system												4063.5663	(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)												393.9281	(232)
Total delivered energy for all uses												5819.4050	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4063.5663	3.4800	141.4121 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1286.9106	3.4800	44.7845 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	393.9281	13.1900	51.9591 (250)
Additional standing charges			120.0000 (251)
Total energy cost			368.0482 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.0940 (257)
SAP value	84.7389
SAP rating (Section 12)	85 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4063.5663	0.2160	877.7303 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1286.9106	0.2160	277.9727 (264)
Space and water heating			1155.7030 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.9281	0.5190	204.4487 (268)
Total kg/year			1399.0767 (272)
CO2 emissions per m2			14.5300 (273)
EI value			86.7320
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9020 = 3.858$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9020 = 0.2395$, stars = 4
Water heating energy efficiency	$3.48 / 0.8359 = 4.163$, stars = 5
Water heating environmental impact	$0.216 / 0.8359 = 0.2584$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3695 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3695 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate	0.4526	0.4249	0.4157	0.3880	0.3880	0.3787	0.3787	0.3695	0.3695	0.3972	0.3972	0.4064 (22b)
Effective ac	0.6024	0.5903	0.5864	0.5753	0.5753	0.5717	0.5717	0.5683	0.5683	0.5789	0.5789	0.5826 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			22.2600	1.3258	29.4981		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	141.0010	24.2950	116.7060	0.2100	24.5083	7.4000	863.6244 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2940				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.9731		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6132.9357 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.6857 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9047 (36)
Total fabric heat loss						(33) + (36) =	88.8778 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	47.7658	46.8018	46.4940	45.6111	45.6111	45.3304	45.3304	45.0564	45.0564	45.8986	45.8986	46.1929 (38)
Heat transfer coeff	136.6436	135.6796	135.3718	134.4889	134.4889	134.2082	134.2082	133.9342	133.9342	134.7764	134.7764	135.0707 (39)
Average = Sum(39)m / 12 =												134.7984 (39)
HLP	1.4189	1.4089	1.4057	1.3966	1.3966	1.3936	1.3936	1.3908	1.3908	1.3995	1.3995	1.4026 (40)
HLP (average)												1.3998 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495	(61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(62)
WWHRS	-52.9687	-46.6059	-47.5672	-39.1354	-36.3372	-29.9758	-25.3685	-30.7157	-31.6123	-39.0801	-45.2705	-51.1970	eq. (G10)
Total of WWHRS savings												-475.8342	
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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424	(65)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)
Total per year (kWh/year) = Sum(64)m =													1078.7427 (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	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7646	49.5296	40.2802	30.4947	22.7951	19.2446	20.7945	27.0295	36.2789	46.0644	53.7640	57.3145	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.4383	377.3135	367.5483	346.7594	320.5171	295.8531	279.3760	275.5009	285.2660	306.0549	332.2972	356.9613	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806	(72)
Total internal gains	612.1222	607.4907	583.7490	546.7300	508.6019	474.4973	454.5698	463.3429	484.6411	521.8848	563.3427	594.9247	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					1.5320	13.4684	0.7300	0.7200	0.7700		7.5156 (74)	
East					7.3910	25.1733	0.7300	0.7200	0.7700		67.7690 (76)	
South					3.0640	56.5862	0.7300	0.7200	0.7700		63.1521 (78)	
West					10.2710	25.1733	0.7300	0.7200	0.7700		94.1761 (80)	
Solar gains	232.6128	369.5738	585.5213	825.1655	934.7899	1050.2613	968.7291	878.5506	703.9148	468.5206	285.0689	190.7473 (83)
Total gains	844.7350	977.0646	1169.2703	1371.8955	1443.3918	1524.7586	1423.2989	1341.8935	1188.5558	990.4053	848.4116	785.6720 (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	12.4674	12.5560	12.5846	12.6672	12.6672	12.6937	12.6937	12.7196	12.7196	12.6401	12.6401	12.6126	
alpha	1.8312	1.8371	1.8390	1.8445	1.8445	1.8462	1.8462	1.8480	1.8480	1.8427	1.8427	1.8408	
util living area	0.8772	0.8443	0.7756	0.6697	0.5463	0.3861	0.2854	0.2920	0.4889	0.7014	0.8313	0.8873	(86)
MIT	18.1601	18.4710	19.1090	19.8374	20.4180	20.7962	20.9220	20.9216	20.6687	19.9859	19.0074	18.1264	(87)
Th 2	19.7488	19.7565	19.7589	19.7660	19.7660	19.7682	19.7682	19.7704	19.7704	19.7637	19.7637	19.7613	(88)
util rest of house	0.8619	0.8258	0.7491	0.6309	0.4893	0.3083	0.1873	0.1888	0.4074	0.6532	0.8069	0.8730	(89)
MIT 2	16.1578	16.5887	17.4644	18.4423	19.1866	19.6183	19.7346	19.7380	19.5024	18.6717	17.3512	16.1167	(90)
Living area fraction									fLA = Living area / (4) =			0.1967	(91)
MIT	16.5516	16.9589	17.7879	18.7167	19.4288	19.8500	19.9681	19.9708	19.7318	18.9302	17.6770	16.5120	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.4016	16.8089	17.6379	18.5667	19.2788	19.7000	19.8181	19.8208	19.5818	18.7802	17.5270	16.3620	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8039	0.7661	0.6922	0.5868	0.4643	0.3036	0.1915	0.1933	0.3936	0.6068	0.7477	0.8165	(94)
Ext temp.	679.0969	748.5542	809.3201	804.9983	670.2122	462.9732	272.5209	259.3214	467.7597	601.0228	634.3174	641.4642	(95)
Heat loss rate W	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000	(96)
Month fracti	1462.3104	1452.9778	1345.3077	1138.6739	830.9747	509.9897	284.2655	270.6516	546.6924	873.3792	1176.1873	1426.6173	(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	582.7109	473.3727	398.7748	240.2464	119.6073	0.0000	0.0000	0.0000	0.0000	202.6331	390.1463	584.1539	(98)
Space heating per m2												2991.6454	(98)
(98) / (4) =													31.0659 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.2000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3316.6801	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	582.7109	473.3727	398.7748	240.2464	119.6073	0.0000	0.0000	0.0000	0.0000	202.6331	390.1463	584.1539	(98)	
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)	
Space heating fuel (main heating system)	646.0210	524.8034	442.1006	266.3486	132.6024	0.0000	0.0000	0.0000	0.0000	224.6487	432.5347	647.6207	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)	
Efficiency of water heater (217)m	87.7188	87.5708	87.0982	86.0440	83.8904	76.4000	76.4000	76.4000	76.4000	85.3628	87.0317	87.7864	(216)	
Fuel for water heating, kWh/month	123.3426	107.7650	112.4371	101.9173	101.7242	98.1690	94.1205	105.9296	106.5275	108.5134	113.1529	119.4730	(219)	
Water heating fuel used												1293.0720	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3316.6801	(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)													393.9281	(232)
Total delivered energy for all uses													5078.6802	(238)

10a. Fuel costs - using BEDF prices (559)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3316.6801	5.7300	190.0458 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1293.0720	5.7300	74.0930 (247)
Pumps and fans for heating	75.0000	24.1800	18.1350 (249)
Energy for lighting	393.9281	24.1800	95.2518 (250)
Additional standing charges			114.0000 (251)
Total energy cost			491.5256 (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	3316.6801	0.2160	716.4029 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1293.0720	0.2160	279.3035 (264)
Space and water heating			995.7064 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.9281	0.5190	204.4487 (268)
Total kg/year			1239.0801 (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	3316.6801	1.2200	4046.3497 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1293.0720	1.2200	1577.5478 (264)
Space and water heating			5623.8975 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	393.9281	3.0700	1209.3593 (268)
Primary energy kWh/year			7063.5068 (272)
Primary energy kWh/m2/year			73.3490 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:
Current environmental impact rating:

B 85
B 87

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	SAP increase too small
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 9.4	-£ 471	-1010 kg (81.5%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.9	-£ 34	-148 kg (11.9%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£471 10.49 kg/m²	A 94	A 95
Total Savings	£471 10.49 kg/m²		

Potential energy efficiency rating:	A 94
Potential environmental impact rating:	A 95

Fuel prices for cost data on this page from database revision number 559 TEST (13 Dec 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£113	£113	£0
Mains gas	£378	£378	£0
Space heating	£322	£322	£0
Water heating	£74	£74	£0
Lighting	£95	£95	£0
Generated (PV)	-£0	-£471	£471
Total cost of fuels	£491	£20	£471
Total cost of uses	£491	£20	£471
Delivered energy	53 kWh/m²	33 kWh/m²	20 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.2 tonnes	1.0 tonnes
CO2 emissions per m²	13 kg/m²	2 kg/m²	10 kg/m²
Primary energy	73 kWh/m²	11 kWh/m²	62 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3695 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3695 (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	0.4711	0.4619	0.4526	0.4064	0.3972	0.3510	0.3510	0.3418	0.3695	0.3972	0.4157	0.4341 (22b)
Effective ac	0.6110	0.6067	0.6024	0.5826	0.5789	0.5616	0.5616	0.5584	0.5683	0.5789	0.5864	0.5942 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			22.2600	1.3258	29.4981		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	141.0010	24.2950	116.7060	0.2100	24.5083	7.4000	863.6244 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2940				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.9731		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6132.9357 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.6857 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9047 (36)
Total fabric heat loss						(33) + (36) =	88.8778 (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	48.4423	48.1007	47.7658	46.1929	45.8986	44.5287	44.5287	44.2750	45.0564	45.8986	46.4940	47.1163 (38)
Heat transfer coeff	137.3201	136.9785	136.6436	135.0707	134.7764	133.4065	133.4065	133.1528	133.9342	134.7764	135.3718	135.9942 (39)
Average = Sum(39)m / 12 =												135.0693 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.4260	1.4224	1.4189	1.4026	1.3995	1.3853	1.3853	1.3827	1.3908	1.3995	1.4057	1.4122 (40)
HLP (average)												1.4026 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495	(61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(62)
WWHRS	-52.9687	-46.6059	-47.5672	-39.1354	-36.3372	-29.9758	-25.3685	-30.7157	-31.6123	-39.0801	-45.2705	-51.1970	eq. (G10)
Total of WWHRS savings												-475.8342	
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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424	(65)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)
Total per year (kWh/year) = Sum(64)m =													1078.7427 (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	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7646	49.5296	40.2802	30.4947	22.7951	19.2446	20.7945	27.0295	36.2789	46.0644	53.7640	57.3145	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.4383	377.3135	367.5483	346.7594	320.5171	295.8531	279.3760	275.5009	285.2660	306.0549	332.2972	356.9613	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806	(72)
Total internal gains	612.1222	607.4907	583.7490	546.7300	508.6019	474.4973	454.5698	463.3429	484.6411	521.8848	563.3427	594.9247	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.5320	10.6334	0.7300	0.7200	0.7700	5.9336 (74)
East	7.3910	19.6403	0.7300	0.7200	0.7700	52.8736 (76)
South	3.0640	46.7521	0.7300	0.7200	0.7700	52.1769 (78)
West	10.2710	19.6403	0.7300	0.7200	0.7700	73.4765 (80)

Solar gains	184.4607	343.9594	535.1696	747.6336	897.4430	912.7855	871.2741	759.1969	610.2907	398.9517	226.7111	153.9364	(83)
Total gains	796.5829	951.4502	1118.9185	1294.3636	1406.0449	1387.2828	1325.8438	1222.5399	1094.9318	920.8365	790.0537	748.8611	(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	12.4060	12.4369	12.4674	12.6126	12.6401	12.7699	12.7699	12.7943	12.7196	12.6401	12.5846	12.5270	
alpha	1.8271	1.8291	1.8312	1.8408	1.8427	1.8513	1.8513	1.8530	1.8480	1.8427	1.8390	1.8351	
util living area	0.9004	0.8653	0.8093	0.7205	0.6105	0.4869	0.3822	0.4203	0.5928	0.7731	0.8714	0.9094	(86)
MIT	17.6940	18.0964	18.7363	19.5128	20.1616	20.6191	20.8287	20.7891	20.4140	19.5362	18.4748	17.6156	(87)
Th 2	19.7435	19.7462	19.7488	19.7613	19.7637	19.7746	19.7746	19.7766	19.7704	19.7637	19.7589	19.7540	(88)
util rest of house	0.8887	0.8499	0.7873	0.6878	0.5626	0.4181	0.2921	0.3291	0.5266	0.7383	0.8540	0.8986	(89)
MIT 2	15.5001	16.0606	16.9477	18.0092	18.8640	19.4366	19.6636	19.6317	19.2118	18.0747	16.6079	15.3931	(90)
Living area fraction									fLA = Living area / (4) =			0.1967	(91)
MIT	15.9316	16.4610	17.2995	18.3049	19.1192	19.6692	19.8927	19.8593	19.4482	18.3622	16.9751	15.8302	(92)
Temperature adjustment												-0.1500	
adjusted MIT	15.7816	16.3110	17.1495	18.1549	18.9692	19.5192	19.7427	19.7093	19.2982	18.2122	16.8251	15.6802	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	664.1511	752.4338	814.3911	824.0638	741.8943	558.1492	383.9146	395.6571	544.6762	628.6144	628.6510	633.2672	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1576.6590	1563.0640	1455.1881	1250.0641	979.7197	656.2488	419.2595	440.6440	696.2189	1025.9389	1316.5002	1561.2393	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	678.9058	544.7435	476.7530	306.7202	176.9421	0.0000	0.0000	0.0000	0.0000	295.6094	495.2515	690.4112	(98)
Space heating												3665.3368	(98)
Space heating per m2												38.0616	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4063.5663 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	678.9058	544.7435	476.7530	306.7202	176.9421	0.0000	0.0000	0.0000	0.0000	295.6094	495.2515	690.4112	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	752.6672	603.9285	528.5510	340.0446	196.1664	0.0000	0.0000	0.0000	0.0000	327.7267	549.0593	765.4227	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Efficiency of water heater (217)m	88.0147	87.8567	87.5065	86.7174	85.1932	76.4000	76.4000	76.4000	76.4000	86.4733	87.5762	76.4000	(216)
Fuel for water heating, kWh/month	122.9279	107.4142	111.9125	101.1259	100.1686	98.1690	94.1205	105.9296	106.5275	107.1198	112.4493	119.0459	(219)
Water heating fuel used												1286.9106	(219)
Annual totals kWh/year													
Space heating fuel - main system												4063.5663	(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)												393.9281	(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												4092.1656	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4063.5663	3.4800	141.4121 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1286.9106	3.4800	44.7845 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	393.9281	13.1900	51.9591 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			140.2253 (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] =	0.4168 (257)
SAP value		94.1856
SAP rating (Section 12)		94 (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	4063.5663	0.2160	877.7303 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1286.9106	0.2160	277.9727 (264)
Space and water heating			1155.7030 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.9281	0.5190	204.4487 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			502.6395 (272)
CO2 emissions per m2			5.2200 (273)
EI value			95.2333
EI rating			95 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

SAP 2012 WORKSHEET FOR New Build (As Built) (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	48.1500 (1b)	x 2.3700 (2b)	= 114.1155 (1b) - (3b)
First floor	48.1500 (1c)	x 2.6200 (2c)	= 126.1530 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	96.3000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 240.2685 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1665 (8)
Pressure test					Yes
Measured/design AP50					4.0600
Infiltration rate					0.3695 (18)
Number of sides sheltered					0 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	1.0000 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3695 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.9000	4.6000	4.5000	4.2000	4.2000	4.1000	4.1000	4.0000	4.0000	4.3000	4.3000	4.4000 (22)
Wind factor	1.2250	1.1500	1.1250	1.0500	1.0500	1.0250	1.0250	1.0000	1.0000	1.0750	1.0750	1.1000 (22a)
Adj infilt rate												
Effective ac	0.4526	0.4249	0.4157	0.3880	0.3880	0.3787	0.3787	0.3695	0.3695	0.3972	0.3972	0.4064 (22b)
	0.6024	0.5903	0.5864	0.5753	0.5753	0.5717	0.5717	0.5683	0.5683	0.5789	0.5789	0.5826 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0400	1.2000	2.4480		(26)
Windows (Uw = 1.40)			22.2600	1.3258	29.4981		(27)
Flr - Ground			48.1490	0.1800	8.6668	75.6000	3640.0644 (28a)
Wl - Brick (Timber Frame)	141.0010	24.2950	116.7060	0.2100	24.5083	7.4000	863.6244 (29a)
Rf - Ins Joist	48.1490		48.1490	0.0800	3.8519	7.4000	356.3026 (30)
Total net area of external elements Aum(A, m ²)			237.2940				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	68.9731		(33)
Stud			75.7215			7.4000	560.3391 (32c)
Internal Floor			48.1490			7.4000	356.3026 (32d)
Internal Ceiling			48.1490			7.4000	356.3026 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	6132.9357 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							63.6857 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.9047 (36)
Total fabric heat loss						(33) + (36) =	88.8778 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	47.7658	46.8018	46.4940	45.6111	45.6111	45.3304	45.3304	45.0564	45.0564	45.8986	45.8986	46.1929 (38)
Heat transfer coeff	136.6436	135.6796	135.3718	134.4889	134.4889	134.2082	134.2082	133.9342	133.9342	134.7764	134.7764	135.0707 (39)
Average = Sum(39)m / 12 =												134.7984 (39)
HLP	1.4189	1.4089	1.4057	1.3966	1.3966	1.3936	1.3936	1.3908	1.3908	1.3995	1.3995	1.4026 (40)
HLP (average)												1.3998 (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												2.7025 (42)
Average daily hot water use (litres/day)												98.3851 (43)
Daily hot water use	108.2237	104.2883	100.3528	96.4174	92.4820	88.5466	88.5466	92.4820	96.4174	100.3528	104.2883	108.2237 (44)
Energy conte	160.4926	140.3678	144.8470	126.2811	121.1698	104.5603	96.8905	111.1832	112.5111	131.1209	143.1287	155.4285 (45)
Energy content (annual)										Total = Sum(45)m =		1547.9814 (45)
Distribution loss (46)m = 0.15 x (45)m	24.0739	21.0552	21.7271	18.9422	18.1755	15.6840	14.5336	16.6775	16.8767	19.6681	21.4693	23.3143 (46)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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	0.6707	0.6087	0.6509	0.5479	0.5043	0.4166	0.3861	0.4627	0.4882	0.5892	0.6207	0.6495	(61)
Total heat required for water heating calculated for each month	161.1633	140.9765	145.4979	126.8290	121.6740	104.9769	97.2765	111.6460	112.9993	131.7101	143.7493	156.0780	(62)
WWHRS	-52.9687	-46.6059	-47.5672	-39.1354	-36.3372	-29.9758	-25.3685	-30.7157	-31.6123	-39.0801	-45.2705	-51.1970	eq. (G10)
Total of WWHRS savings												-475.8342	
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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Heat gains from water heating, kWh/month	53.5315	46.8245	48.3244	42.1255	40.4150	34.8705	32.3126	37.0841	37.5320	43.7450	47.7455	51.8424	(65)
Solar input (sum of months) = Sum(63)m =													0.0000 (63)
Total per year (kWh/year) = Sum(64)m =													1078.7427 (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	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	162.1519	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.7646	49.5296	40.2802	30.4947	22.7951	19.2446	20.7945	27.0295	36.2789	46.0644	53.7640	57.3145	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	373.4383	377.3135	367.5483	346.7594	320.5171	295.8531	279.3760	275.5009	285.2660	306.0549	332.2972	356.9613	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	53.9177	(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)	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	-108.1013	(71)
Water heating gains (Table 5)	71.9509	69.6793	64.9521	58.5076	54.3213	48.4312	43.4309	49.8442	52.1278	58.7970	66.3131	69.6806	(72)
Total internal gains	612.1222	607.4907	583.7490	546.7300	508.6019	474.4973	454.5698	463.3429	484.6411	521.8848	563.3427	594.9247	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.5320	13.4684	0.7300	0.7200	0.7700	7.5156 (74)
East	7.3910	25.1733	0.7300	0.7200	0.7700	67.7690 (76)
South	3.0640	56.5862	0.7300	0.7200	0.7700	63.1521 (78)
West	10.2710	25.1733	0.7300	0.7200	0.7700	94.1761 (80)

Solar gains	232.6128	369.5738	585.5213	825.1655	934.7899	1050.2613	968.7291	878.5506	703.9148	468.5206	285.0689	190.7473	(83)
Total gains	844.7350	977.0646	1169.2703	1371.8955	1443.3918	1524.7586	1423.2989	1341.8935	1188.5558	990.4053	848.4116	785.6720	(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	12.4674	12.5560	12.5846	12.6672	12.6672	12.6937	12.6937	12.7196	12.7196	12.6401	12.6401	12.6126	
alpha	1.8312	1.8371	1.8390	1.8445	1.8445	1.8462	1.8462	1.8480	1.8480	1.8427	1.8427	1.8408	
util living area	0.8772	0.8443	0.7756	0.6697	0.5463	0.3861	0.2854	0.2920	0.4889	0.7014	0.8313	0.8873	(86)
MIT	18.1601	18.4710	19.1090	19.8374	20.4180	20.7962	20.9220	20.9216	20.6687	19.9859	19.0074	18.1264	(87)
Th 2	19.7488	19.7565	19.7589	19.7660	19.7660	19.7682	19.7682	19.7704	19.7704	19.7637	19.7637	19.7613	(88)
util rest of house	0.8619	0.8258	0.7491	0.6309	0.4893	0.3083	0.1873	0.1888	0.4074	0.6532	0.8069	0.8730	(89)
MIT 2	16.1578	16.5887	17.4644	18.4423	19.1866	19.6183	19.7346	19.7380	19.5024	18.6717	17.3512	16.1167	(90)
Living area fraction									fLA = Living area / (4) =			0.1967	(91)
MIT	16.5516	16.9589	17.7879	18.7167	19.4288	19.8500	19.9681	19.9708	19.7318	18.9302	17.6770	16.5120	(92)
Temperature adjustment												-0.1500	
adjusted MIT	16.4016	16.8089	17.6379	18.5667	19.2788	19.7000	19.8181	19.8208	19.5818	18.7802	17.5270	16.3620	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8039	0.7661	0.6922	0.5868	0.4643	0.3036	0.1915	0.1933	0.3936	0.6068	0.7477	0.8165	(94)
Ext temp.	679.0969	748.5542	809.3201	804.9983	670.2122	462.9732	272.5209	259.3214	467.7597	601.0228	634.3174	641.4642	(95)
Heat loss rate W	5.7000	6.1000	7.7000	10.1000	13.1000	15.9000	17.7000	17.8000	15.5000	12.3000	8.8000	5.8000	(96)
Month fracti	1462.3104	1452.9778	1345.3077	1138.6739	830.9747	509.9897	284.2655	270.6516	546.6924	873.3792	1176.1873	1426.6173	(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 per m2	582.7109	473.3727	398.7748	240.2464	119.6073	0.0000	0.0000	0.0000	0.0000	202.6331	390.1463	584.1539	(98)
(98) / (4) =													31.0659 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3316.6801 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	582.7109	473.3727	398.7748	240.2464	119.6073	0.0000	0.0000	0.0000	0.0000	202.6331	390.1463	584.1539	(98)
Space heating efficiency (main heating system 1)	90.2000	90.2000	90.2000	90.2000	90.2000	0.0000	0.0000	0.0000	0.0000	90.2000	90.2000	90.2000	(210)
Space heating fuel (main heating system)	646.0210	524.8034	442.1006	266.3486	132.6024	0.0000	0.0000	0.0000	0.0000	224.6487	432.5347	647.6207	(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	108.1946	94.3706	97.9307	87.6937	85.3368	75.0011	71.9080	80.9302	81.3870	92.6300	98.4789	104.8811	(64)
Efficiency of water heater (217)m	87.7188	87.5708	87.0982	86.0440	83.8904	76.4000	76.4000	76.4000	76.4000	85.3628	87.0317	87.7864	(216)
Fuel for water heating, kWh/month	123.3426	107.7650	112.4371	101.9173	101.7242	98.1690	94.1205	105.9296	106.5275	108.5134	113.1529	119.4730	(219)
Water heating fuel used												1293.0720	(219)
Annual totals kWh/year													
Space heating fuel - main system												3316.6801	(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)												393.9281	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1217 * 0.80) =										-1946.4459		-1946.4459	(233)
Total delivered energy for all uses												3132.2342	(238)

10a. Fuel costs - using BEDF prices (559)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3316.6801	5.7300	190.0458	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1293.0720	5.7300	74.0930	(247)
Pumps and fans for heating	75.0000	24.1800	18.1350	(249)
Energy for lighting	393.9281	24.1800	95.2518	(250)
Additional standing charges			114.0000	(251)
Energy saving/generation technologies				
PV Unit	-1946.4459	24.1800	-470.6506	(252)
Total energy cost			20.8750	(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	3316.6801	0.2160	716.4029	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1293.0720	0.2160	279.3035	(264)
Space and water heating			995.7064	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	393.9281	0.5190	204.4487	(268)
Energy saving/generation technologies				
PV Unit	-1946.4459	0.5190	-1010.2054	(269)
Total kg/year			228.8747	(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	3316.6801	1.2200	4046.3497	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1293.0720	1.2200	1577.5478	(264)
Space and water heating			5623.8975	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	393.9281	3.0700	1209.3593	(268)
Energy saving/generation technologies				
PV Unit	-1946.4459	3.0700	-5975.5890	(269)
Primary energy kWh/year			1087.9178	(272)
Primary energy kWh/m2/year			11.2972	(273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	059 - PRJ013014	Issued on Date	27/01/2025
Assessment Reference	059	Prop Type Ref	D1
Property	17 Erwood Close, Netley Abbey, Southampton, SO31 5TJ		
SAP Rating	85 B	DER	15.35
Environmental	87 B	TER	18.41
CO ₂ Emissions (t/year)	1.24	% DER<TER	16.63
General Requirements Compliance	Pass	DFEE	51.73
		TFEE	58.28
		% DFEE<TFEE	11.24
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk		Assessor ID
			U903-0001
Client			

SUMMARY FOR INPUT DATA FOR New Build (As Built)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.41	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	15.35	kgCO ₂ /m ²	Pass
	-3.06 (-16.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	58.28	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	51.73	kWh/m ² /yr	
	-6.6 (-11.3%)	kWh/m ² /yr	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.08 (max. 0.20)	0.08 (max. 0.35)	Pass
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	4.06 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Vaillant ecoFIT sustain 835 VUW 356/6-3 (H-GB) Combi boiler Efficiency: 89.3% SEDBUK2009 Minimum: 88.0%	Pass
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BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Secondary heating system

None

5 Cylinder insulation

Hot water storage

No cylinder

6 Controls

Space heating controls

Time and temperature zone control

Pass

Hot water controls

No cylinder

Boiler interlock

Yes

Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings

100

%

Minimum

75

%

Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)

Slight

Pass

Based on:

Overshading

Average

Windows facing North

1.53 m², No overhang

Windows facing East

7.39 m², No overhang

Windows facing South

3.06 m², No overhang

Windows facing West

10.27 m², No overhang

Air change rate

4.69 ach

Blinds/curtains

Dark-coloured curtain or roller blind, closed 100% of daylight hours

Criterion 4 – Building performance consistent with DER and DFEE rate

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

4.06 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Roof U-value

0.08

W/m²K

This report has not been submitted through the Elmhurst Energy members' portal, therefore results are subject to change when the dwelling is completed.