

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	080 - PRJ013014			Issued on Date	14/04/2025
Assessment Reference	080	Prop Type Ref	E		
Property	7 Erwood Close, Netley Abbey, Southampton, SO31 5TJ				
SAP Rating	85 B	DER	14.17	TER	17.19
Environmental	89 B	% DER<TER	17.55		
CO ₂ Emissions (t/year)	0.93	DFEE	39.85	TFEE	44.14
General Requirements Compliance	Pass	% DFEE<TFEE	9.73		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	4299-0004
Client					

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

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DWELLING AS BUILT

Mid-Terrace House, total floor area 79 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.19 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.17 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 44.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 39.8 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.21 (max. 0.30)	0.21 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	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	1.36 (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: 3.83 (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 East: 7.24 m², No overhang
Windows facing West: 2.55 m², No overhang
Air change rate: 4.70 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.08 W/m²K
Air permeability 3.8 m³/m²h

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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	39.2600 (1b)	x 2.3700 (2b)	= 93.0462 (1b) - (3b)
First floor	39.2600 (1c)	x 2.6200 (2c)	= 102.8612 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.9074 (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) = 0.2042 (8)
Pressure test					Yes
Measured/design AP50					3.8300
Infiltration rate					0.3957 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3363 (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	0.4288	0.4204	0.4120	0.3700	0.3616	0.3195	0.3195	0.3111	0.3363	0.3616	0.3784	0.3952 (22b)
Effective ac	0.5919	0.5884	0.5849	0.5684	0.5654	0.5510	0.5510	0.5484	0.5566	0.5654	0.5716	0.5781 (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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	46.9520	11.8870	35.0650	0.2100	7.3637	7.4000	259.4810 (29a)
Rf - Ins Joist	39.2630		39.2630	0.0800	3.1410	7.4000	290.5462 (30)
Total net area of external elements Aum(A, m ²)			125.4710				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.0592		(33)
Party Wall			83.4200	0.0000	0.0000	7.4000	617.3080 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2130 (36)
Total fabric heat loss							(33) + (36) = 47.2722 (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	38.2687	38.0379	37.8116	36.7490	36.5502	35.6246	35.6246	35.4532	35.9811	36.5502	36.9524	37.3729 (38)
Heat transfer coeff	85.5409	85.3101	85.0838	84.0212	83.8224	82.8968	82.8968	82.7254	83.2533	83.8224	84.2246	84.6451 (39)
Average = Sum(39)m / 12 =												84.0202 (39)
HLP	1.0894	1.0865	1.0836	1.0701	1.0675	1.0557	1.0557	1.0536	1.0603	1.0675	1.0727	1.0780 (40)
HLP (average)												1.0700 (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												2.4342 (42)
Average daily hot water use (litres/day)												92.0118 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	101.2129	97.5325	93.8520	90.1715	86.4911	82.8106	82.8106	86.4911	90.1715	93.8520	97.5325	101.2129 (44)
Energy conte	150.0959	131.2748	135.4638	118.1007	113.3204	97.7869	90.6139	103.9808	105.2227	122.6269	133.8568	145.3598 (45)
Energy content (annual)												Total = Sum(45)m = 1447.7033 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	22.5144	19.6912	20.3196	17.7151	16.9981	14.6680	13.5921	15.5971	15.7834	18.3940	20.0785	21.8040 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6693	0.5762	0.5721	0.4792	0.4411	0.3644	0.3377	0.4047	0.4270	0.5179	0.5875	0.6482 (61)
Total heat required for water heating calculated for each month	150.7652	131.8510	136.0359	118.5799	113.7614	98.1513	90.9516	104.3855	105.6496	123.1448	134.4443	146.0081 (62)
WWHRS	-48.4321	-42.6122	-43.4923	-35.7971	-33.2450	-27.4302	-23.2236	-28.1156	-28.9319	-35.7563	-41.4062	-46.8089 eq. (G10)
Total of WWHRS savings												-435.2513
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	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991 (64)
Heat gains from water heating, kWh/month	50.0742	43.7929	45.1848	39.3883	37.7893	32.6052	30.2135	34.6748	35.0933	40.9029	44.6543	48.4942 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.0888	18.7309	15.2330	11.5323	8.6206	7.2778	7.8640	10.2219	13.7198	17.4204	20.3322	21.6749 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.3196	218.5643	212.9077	200.8654	185.6642	171.3772	161.8326	159.5879	165.2445	177.2868	192.4880	206.7750 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709 (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)	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672 (71)
Water heating gains (Table 5)	67.3040	65.1680	60.7322	54.7059	50.7921	45.2851	40.6096	46.6059	48.7407	54.9770	62.0198	65.1804 (72)
Total internal gains	367.2251	364.9759	351.3855	329.6163	307.5895	286.4527	272.8188	278.9283	290.2176	312.1969	337.3527	356.1430 (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
East	7.2440	19.6403	0.7300	0.7200	0.7700	51.8220 (76)
West	2.5540	19.6403	0.7300	0.7200	0.7700	18.2708 (80)
Solar gains	70.0928	137.1164	225.8111	329.3321	403.6088	413.1654
Total gains	437.3179	502.0922	577.1966	658.9484	711.1983	699.6182

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	17.1161	17.1624	17.2080	17.4256	17.4670	17.6620	17.6620	17.6986	17.5864	17.4670	17.3836	17.2972
Feb	2.1411	2.1442	2.1472	2.1617	2.1645	2.1775	2.1775	2.1799	2.1724	2.1645	2.1589	2.1531
util living area	0.9436	0.9234	0.8853	0.8153	0.7148	0.5867	0.4692	0.5119	0.6978	0.8568	0.9256	0.9493 (86)
MIT	18.0414	18.3468	18.8898	19.5917	20.2024	20.6451	20.8458	20.8082	20.4433	19.6329	18.7185	17.9873 (87)
Th 2	20.0095	20.0119	20.0143	20.0254	20.0274	20.0371	20.0371	20.0389	20.0334	20.0274	20.0232	20.0188 (88)
util rest of house	0.9372	0.9148	0.8720	0.7929	0.6776	0.5273	0.3864	0.4298	0.6455	0.8344	0.9157	0.9435 (89)
MIT 2	16.0399	16.4796	17.2586	18.2565	19.0990	19.6838	19.9183	19.8835	19.4423	18.3352	17.0260	15.9648 (90)
Living area fraction	16.4457	16.8582	17.5893	18.5272	19.3227	19.8787	20.1064	20.0710	19.6453	18.5983	17.3692	16.3749 (92)
MIT	16.2957	16.7082	17.4393	18.3772	19.1727	19.7287	19.9564	19.9210	19.4953	18.4483	17.2192	16.2249 (93)

8. Space heating requirement

Utilisation	0.9008	0.8731	0.8249	0.7457	0.6396	0.5063	0.3789	0.4187	0.6114	0.7865	0.8746	0.9092 (94)
Useful gains	393.9278	438.3669	476.1409	491.3578	454.8978	354.1939	252.4139	258.2887	337.9975	373.5133	371.4699	376.2273 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1026.1251	1007.3564	930.7580	796.2846	626.3836	425.1560	278.2317	291.2767	449.1743	657.8612	852.2817	1017.8457 (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	470.3548	382.3610	338.2351	219.5473	127.5855	0.0000	0.0000	0.0000	0.0000	211.5548	346.1845	477.3640 (98)
Space heating												2573.1870 (98)
Space heating per m2												(98) / (4) = 32.7711 (99)

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													2852.7572 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	470.3548	382.3610	338.2351	219.5473	127.5855	0.0000	0.0000	0.0000	0.0000	211.5548	346.1845	477.3640	(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)	521.4576	423.9035	374.9835	243.4006	141.4473	0.0000	0.0000	0.0000	0.0000	234.5397	383.7966	529.2284	(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	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991	(64)
Efficiency of water heater (217)m	87.3797	87.2189	86.8306	85.9491	84.3080	76.4000	76.4000	76.4000	76.4000	85.6761	86.8760	76.4000	(216)
Fuel for water heating, kWh/month	117.1131	102.3159	106.5795	96.3161	95.5027	92.5669	88.6492	99.8298	100.4158	101.9986	107.0930	113.3946	(219)
Water heating fuel used												1221.7753	(219)
Annual totals kWh/year													
Space heating fuel - main system												2852.7572	(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)												372.4349	(232)
Total delivered energy for all uses												4521.9675	(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	2852.7572	0.2160	616.1956 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1221.7753	0.2160	263.9035 (264)
Space and water heating			880.0990 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.4349	0.5190	193.2937 (268)
Total CO2, kg/year			1112.3178 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.1700 (273)

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

DER		14.1700	ZC1
Total Floor Area	TFA	78.5200	
Assumed number of occupants	N	2.4342	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.3253	ZC2
CO2 emissions from cooking, equation (L16)		2.2596	ZC3
Total CO2 emissions		32.7549	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		32.7549	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	39.2600 (1b)	x 2.3700 (2b)	= 93.0462 (1b) - (3b)
First floor	39.2600 (1c)	x 2.6200 (2c)	= 102.8612 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.9074 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1531 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4031 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3427 (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	0.4369	0.4283	0.4198	0.3769	0.3684	0.3255	0.3255	0.3170	0.3427	0.3684	0.3855	0.4026	(22b)				
Effective ac	0.5954	0.5917	0.5881	0.5710	0.5678	0.5530	0.5530	0.5502	0.5587	0.5678	0.5743	0.5811	(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			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			9.8000	1.3258	12.9792		(27)					
Flr - Ground			39.2630	0.1300	5.1042		(28a)					
Wl - Brick (Timber Frame)	46.9520	11.8870	35.0650	0.1800	6.3117		(29a)					
Rf - Ins Joist	39.2630		39.2630	0.1300	5.1042		(30)					
Total net area of external elements Aum(A, m2)			125.4710				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	31.5892		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.2598 (36)					
Total fabric heat loss						(33) + (36) =	39.8490 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.4948	Feb 38.2552	Mar 38.0204	Apr 36.9173	May 36.7109	Jun 35.7502	Jul 35.7502	Aug 35.5723	Sep 36.1202	Oct 36.7109	Nov 37.1284	Dec 37.5649 (38)
Heat transfer coeff	78.3438	78.1043	77.8694	76.7663	76.5600	75.5992	75.5992	75.4213	75.9693	76.5600	76.9775	77.4139 (39)
Average = Sum(39)m / 12 =												76.7654 (39)
HLP	Jan 0.9978	Feb 0.9947	Mar 0.9917	Apr 0.9777	May 0.9750	Jun 0.9628	Jul 0.9628	Aug 0.9605	Sep 0.9675	Oct 0.9750	Nov 0.9804	Dec 0.9859 (40)
HLP (average)												0.9777 (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												2.4342 (42)
Average daily hot water use (litres/day)												92.0118 (43)
Daily hot water use	Jan 101.2129	Feb 97.5325	Mar 93.8520	Apr 90.1715	May 86.4911	Jun 82.8106	Jul 82.8106	Aug 86.4911	Sep 90.1715	Oct 93.8520	Nov 97.5325	Dec 101.2129 (44)
Energy conte	150.0959	131.2748	135.4638	118.1007	113.3204	97.7869	90.6139	103.9808	105.2227	122.6269	133.8568	145.3598 (45)
Energy content (annual)										Total = Sum(45)m =		1447.7033 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.5144	19.6912	20.3196	17.7151	16.9981	14.6680	13.5921	15.5971	15.7834	18.3940	20.0785	21.8040 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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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	44.8917	47.8259	44.4681	44.0749	40.8381	42.1994	44.0749	44.4681	47.8259	48.0982	50.9589 (61)
Solar input	201.0548	176.1665	183.2898	162.5688	157.3953	138.6250	132.8133	148.0557	149.6908	170.4528	181.9550	196.3187 (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	201.0548	176.1665	183.2898	162.5688	157.3953	138.6250	132.8133	148.0557	149.6908	170.4528	181.9550	196.3187 (64)
Heat gains from water heating, kWh/month	62.6466	54.8718	56.9982	50.3855	48.6978	42.7237	40.6790	45.5923	46.1036	52.7299	56.5319	61.0719 (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	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	121.7090	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.2210	18.8483	15.3285	11.6046	8.6746	7.3235	7.9133	10.2860	13.8058	17.5296	20.4597	21.8108	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	216.3196	218.5643	212.9077	200.8654	185.6642	171.3772	161.8326	159.5879	165.2445	177.2868	192.4880	206.7750	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	35.1709	(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)	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	(71)
Water heating gains (Table 5)	84.2024	81.6544	76.6105	69.9799	65.4540	59.3384	54.6760	61.2800	64.0327	70.8735	78.5166	82.0858	(72)
Total internal gains	384.2557	381.5797	367.3593	344.9626	322.3054	300.5517	286.9346	293.6665	305.5957	328.2026	353.9769	373.1843	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
East					7.2440	19.6403	0.6300	0.7000			0.7700	43.4808 (76)
West					2.5540	19.6403	0.6300	0.7000			0.7700	15.3299 (80)
Solar gains	58.8107	115.0463	189.4648	276.3231	338.6444	346.6628	330.0371	283.4970	220.3554	136.5121	73.3301	48.3631 (83)
Total gains	443.0664	496.6260	556.8241	621.2857	660.9498	647.2145	616.9717	577.1635	525.9511	464.7147	427.3070	421.5474 (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	69.6006	69.8141	70.0246	71.0308	71.2223	72.1274	72.1274	72.2976	71.7761	71.2223	70.8360	70.4366	
alpha	5.6400	5.6543	5.6683	5.7354	5.7482	5.8085	5.8085	5.8198	5.7851	5.7482	5.7224	5.6958	
util living area	0.9985	0.9968	0.9907	0.9647	0.8816	0.7072	0.5322	0.5883	0.8512	0.9806	0.9968	0.9989	(86)
MIT	19.9347	20.0615	20.2888	20.5931	20.8402	20.9676	20.9947	20.9909	20.9053	20.5793	20.2051	19.9157	(87)
Th 2	20.0852	20.0877	20.0902	20.1020	20.1042	20.1144	20.1144	20.1163	20.1105	20.1042	20.0997	20.0951	(88)
util rest of house	0.9980	0.9958	0.9874	0.9516	0.8401	0.6254	0.4288	0.4819	0.7863	0.9711	0.9956	0.9985	(89)
MIT 2	18.6537	18.8407	19.1731	19.6159	19.9447	20.0924	20.1124	20.1124	20.0324	19.6042	19.0598	18.6332	(90)
Living area fraction									fLA = Living area / (4) =			0.2028	(91)
MIT	18.9134	19.0882	19.3993	19.8141	20.1263	20.2699	20.2913	20.2905	20.2094	19.8019	19.2920	18.8932	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9134	19.0882	19.3993	19.8141	20.1263	20.2699	20.2913	20.2905	20.2094	19.8019	19.2920	18.8932	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	441.7799	493.6815	547.8913	587.9385	556.0489	414.5696	277.5268	290.5861	417.8548	449.3150	424.7143	420.6164	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1144.8736	1108.1619	1004.4590	837.8318	645.1141	428.6387	279.0571	293.4278	464.1281	704.4954	938.5128	1137.4578	(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	523.1017	412.9308	339.6864	179.9232	66.2645	0.0000	0.0000	0.0000	0.0000	189.8542	369.9349	533.3300	(98)
Space heating												2615.0258	(98)
Space heating per m2												33.3039	(99)

8c. Space cooling requirement

Not applicable

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

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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													2799.8135 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	523.1017	412.9308	339.6864	179.9232	66.2645	0.0000	0.0000	0.0000	0.0000	189.8542	369.9349	533.3300	(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)	560.0661	442.1101	363.6899	192.6373	70.9470	0.0000	0.0000	0.0000	0.0000	203.2700	396.0759	571.0171	(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	201.0548	176.1665	183.2898	162.5688	157.3953	138.6250	132.8133	148.0557	149.6908	170.4528	181.9550	196.3187	(64)
Efficiency of water heater	87.3497	87.1230	86.5832	85.3070	83.0490	80.3000	80.3000	80.3000	80.3000	85.3230	86.8005	87.4408	(217)
Fuel for water heating, kWh/month	230.1724	202.2043	211.6920	190.5692	189.5209	172.6338	165.3964	184.3782	186.4144	199.7735	209.6243	224.5161	(219)
Water heating fuel used												2366.8955	(219)
Annual totals kWh/year													
Space heating fuel - main system												2799.8135	(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)												374.7696	(232)
Total delivered energy for all uses												5616.4785	(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	2799.8135	0.2160	604.7597 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2366.8955	0.2160	511.2494 (264)
Space and water heating			1116.0091 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	374.7696	0.5190	194.5054 (268)
Total CO2, kg/m2/year			1349.4396 (272)
Emissions per m2 for space and water heating			14.2131 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4771 (272b)
Emissions per m2 for pumps and fans			0.4957 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.2131 * 1.00) + 2.4771 + 0.4957, rounded to 2 d.p.			17.1900 (273)

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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	39.2600 (1b)	x 2.3700 (2b)	= 93.0462 (1b) - (3b)
First floor	39.2600 (1c)	x 2.6200 (2c)	= 102.8612 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.9074 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.2042 (8)
Pressure test										Yes							
Measured/design AP50																	3.8300
Infiltration rate																	0.3957 (18)
Number of sides sheltered																	2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3363 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4120	0.3868	0.3784	0.3531	0.3531	0.3447	0.3447	0.3363	0.3363	0.3616	0.3616	0.3700	(22b)				
Effective ac	0.5849	0.5748	0.5716	0.5624	0.5624	0.5594	0.5594	0.5566	0.5566	0.5654	0.5654	0.5684	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			2.0900	1.2000	2.5080		(26)						
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)						
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)						
Wl - Brick (Timber Frame)	46.9520	11.8870	35.0650	0.2100	7.3637	7.4000	259.4810 (29a)						
Rf - Ins Joist	39.2630		39.2630	0.0800	3.1410	7.4000	290.5462 (30)						
Total net area of external elements Aum(A, m2)			125.4710				(31)						
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.0592		(33)						
Party Wall			83.4200	0.0000	0.0000	7.4000	617.3080 (32)						
Stud			74.8825			7.4000	554.1306 (32c)						
Internal Floor			39.2630			7.4000	290.5462 (32d)						
Internal Ceiling			39.2630			7.4000	290.5462 (32e)						
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)						
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							67.1274 (35)						
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2130 (36)						
Total fabric heat loss						(33) + (36) =	47.2722 (37)						
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	37.8116	37.1603	36.9524	36.3559	36.1663	35.9811	35.9811	36.5502	36.5502	36.7490	(38)		
Heat transfer coeff	85.0838	84.4325	84.2246	83.6281	83.6281	83.4384	83.4384	83.2533	83.2533	83.8224	83.8224	84.0212 (39)	
Average = Sum(39)m / 12 =												83.8372 (39)	
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0836	1.0753	1.0727	1.0651	1.0651	1.0626	1.0626	1.0603	1.0603	1.0675	1.0675	1.0701	(40)
HLP (average)												1.0677	(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												2.4342 (42)
Average daily hot water use (litres/day)												92.0118 (43)
Daily hot water use	Jan 101.2129	Feb 97.5325	Mar 93.8520	Apr 90.1715	May 86.4911	Jun 82.8106	Jul 82.8106	Aug 86.4911	Sep 90.1715	Oct 93.8520	Nov 97.5325	Dec 101.2129 (44)
Energy conte	150.0959	131.2748	135.4638	118.1007	113.3204	97.7869	90.6139	103.9808	105.2227	122.6269	133.8568	145.3598 (45)
Energy content (annual)												Total = Sum(45)m = 1447.7033 (45)
Distribution loss (46)m = 0.15 x (45)m												

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	22.5144	19.6912	20.3196	17.7151	16.9981	14.6680	13.5921	15.5971	15.7834	18.3940	20.0785	21.8040 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6693	0.5762	0.5721	0.4792	0.4411	0.3644	0.3377	0.4047	0.4270	0.5179	0.5875	0.6482 (61)
Total heat required for water heating calculated for each month	150.7652	131.8510	136.0359	118.5799	113.7614	98.1513	90.9516	104.3855	105.6496	123.1448	134.4443	146.0081 (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	150.7652	131.8510	136.0359	118.5799	113.7614	98.1513	90.9516	104.3855	105.6496	123.1448	134.4443	146.0081 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	50.0742	43.7929	45.1848	39.3883	37.7893	32.6052	30.2135	34.6748	35.0933	40.9029	44.6543	48.4942 (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	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.7220	46.8272	38.0825	28.8309	21.5514	18.1946	19.6599	25.5547	34.2995	43.5511	50.8305	54.1873 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.8650	326.2153	317.7726	299.7991	277.1107	255.7868	241.5411	238.1908	246.6335	264.6071	287.2955	308.6193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393 (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)	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672 (71)
Water heating gains (Table 5)	67.3040	65.1680	60.7322	54.7059	50.7921	45.2851	40.6096	46.6059	48.7407	54.9770	62.0198	65.1804 (72)
Total internal gains	546.6139	541.9334	520.3101	487.0587	453.1770	422.9893	405.5335	414.0743	433.3965	466.8580	503.8686	531.7099 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W
East					7.2440	25.1733	0.7300	0.7200			0.7700	66.4212 (76)
West					2.5540	25.1733	0.7300	0.7200			0.7700	23.4179 (80)
Solar gains	89.8391	149.4989	249.8546	366.0685	422.1487	476.8123	438.8679	393.2507	305.8337	193.6690	111.6521	72.6192 (83)
Total gains	636.4530	691.4324	770.1647	853.1272	875.3257	899.8016	844.4014	807.3250	739.2303	660.5270	615.5207	604.3291 (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	17.2080	17.3407	17.3836	17.5075	17.5075	17.5473	17.5473	17.5864	17.5864	17.4670	17.4670	17.4256
alpha	2.1472	2.1560	2.1589	2.1672	2.1672	2.1698	2.1698	2.1724	2.1724	2.1645	2.1645	2.1617
util living area	0.8771	0.8540	0.7994	0.7066	0.5842	0.4188	0.3062	0.3095	0.5128	0.7171	0.8340	0.8847 (86)
MIT	18.8290	19.0436	19.5197	20.0911	20.5604	20.8564	20.9505	20.9512	20.7675	20.2484	19.5023	18.8189 (87)
Th 2	20.0143	20.0211	20.0232	20.0295	20.0295	20.0315	20.0315	20.0334	20.0334	20.0274	20.0274	20.0254 (88)
util rest of house	0.8638	0.8386	0.7781	0.6750	0.5365	0.3522	0.2230	0.2229	0.4447	0.6773	0.8133	0.8720 (89)
MIT 2	17.1666	17.4725	18.1435	18.9348	19.5569	19.9115	20.0045	20.0078	19.8237	19.1667	18.1352	17.1584 (90)
Living area fraction	17.5036	17.7910	18.4226	19.1692	19.7604	20.1031	20.1963	20.1990	20.0151	19.3861	18.4124	17.4951 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3536	17.6410	18.2726	19.0192	19.6104	19.9531	20.0463	20.0490	19.8651	19.2361	18.2624	17.3451 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.8162	0.7904	0.7315	0.6373	0.5140	0.3465	0.2243	0.2244	0.4319	0.6394	0.7655	0.8253 (94)
Ext temp.	519.5018	546.5250	563.3471	543.6634	449.8856	311.7458	189.4058	181.1680	319.2606	422.3424	471.1948	498.7709 (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	991.5364	974.4369	890.4691	745.8968	544.4516	338.1865	195.7746	187.2396	363.4054	581.3966	793.1591	970.0292 (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	351.1937	287.5568	243.3788	145.6081	70.3571	0.0000	0.0000	0.0000	0.0000	118.3363	231.8143	350.6162 (98)
RHI space heating demand												1798.8612 (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	39.2600 (1b)	x 2.3700 (2b)	= 93.0462 (1b) - (3b)
First floor	39.2600 (1c)	x 2.6200 (2c)	= 102.8612 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.9074 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							4 * 10 =	40.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						40.0000 / (5) =	0.2042 (8)				
Pressure test							Yes					
Measured/design AP50								3.8300				
Infiltration rate								0.3957 (18)				
Number of sides sheltered								2 (19)				
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.8500 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.3363 (21)				
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4288	0.4204	0.4120	0.3700	0.3616	0.3195	0.3195	0.3111	0.3363	0.3616	0.3784	0.3952 (22b)
Effective ac	0.5919	0.5884	0.5849	0.5684	0.5654	0.5510	0.5510	0.5484	0.5566	0.5654	0.5716	0.5781 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K						
Solid Door			2.0900	1.2000	2.5080			(26)					
Windows (Uw = 1.40)			9.8000	1.3258	12.9792			(27)					
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828	(28a)					
Wl - Brick (Timber Frame)	46.9520	11.8870	35.0650	0.2100	7.3637	7.4000	259.4810	(29a)					
Rf - Ins Joist	39.2630		39.2630	0.0800	3.1410	7.4000	290.5462	(30)					
Total net area of external elements Aum(A, m2)			125.4710					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.0592			(33)					
Party Wall			83.4200	0.0000	0.0000	7.4000	617.3080	(32)					
Stud			74.8825			7.4000	554.1306	(32c)					
Internal Floor			39.2630			7.4000	290.5462	(32d)					
Internal Ceiling			39.2630			7.4000	290.5462	(32e)					
Heat capacity Cm = Sum(A x k)								(28)...(30) + (32) + (32a)...(32e) =					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								5270.8410 (34)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								67.1274 (35)					
Total fabric heat loss								14.2130 (36)					
								(33) + (36) =					
								47.2722 (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	38.2687	38.0379	37.8116	36.7490	36.5502	35.6246	35.6246	35.4532	35.9811	36.5502	36.9524	37.3729	(38)
Heat transfer coeff													
	85.5409	85.3101	85.0838	84.0212	83.8224	82.8968	82.8968	82.7254	83.2533	83.8224	84.2246	84.6451	(39)
Average = Sum(39)m / 12 =												84.0202	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0894	1.0865	1.0836	1.0701	1.0675	1.0557	1.0557	1.0536	1.0603	1.0675	1.0727	1.0780	(40)
HLP (average)												1.0700	(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												2.4342 (42)
Average daily hot water use (litres/day)												92.0118 (43)
Daily hot water use	Jan 101.2129	Feb 97.5325	Mar 93.8520	Apr 90.1715	May 86.4911	Jun 82.8106	Jul 82.8106	Aug 86.4911	Sep 90.1715	Oct 93.8520	Nov 97.5325	Dec 101.2129 (44)
Energy conte	150.0959	131.2748	135.4638	118.1007	113.3204	97.7869	90.6139	103.9808	105.2227	122.6269	133.8568	145.3598 (45)
Energy content (annual)												Total = Sum(45)m = 1447.7033 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	22.5144	19.6912	20.3196	17.7151	16.9981	14.6680	13.5921	15.5971	15.7834	18.3940	20.0785	21.8040 (46)
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6693	0.5762	0.5721	0.4792	0.4411	0.3644	0.3377	0.4047	0.4270	0.5179	0.5875	0.6482 (61)
Total heat required for water heating calculated for each month												
	150.7652	131.8510	136.0359	118.5799	113.7614	98.1513	90.9516	104.3855	105.6496	123.1448	134.4443	146.0081 (62)
WWHRS	-48.4321	-42.6122	-43.4923	-35.7971	-33.2450	-27.4302	-23.2236	-28.1156	-28.9319	-35.7563	-41.4062	-46.8089 eq. (G10)
Total of WWHRS savings												-435.2513
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input	(sum of months) =	Sum(63)m =		0.0000 (63)
Output from w/h												
	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991 (64)
								Total per year (kWh/year) =	Sum(64)m =			1018.4772 (64)
Heat gains from water heating, kWh/month												
	50.0742	43.7929	45.1848	39.3883	37.7893	32.6052	30.2135	34.6748	35.0933	40.9029	44.6543	48.4942 (65)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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												2469.9839 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	411.9542	334.3779	294.1337	188.1244	106.6789	0.0000	0.0000	0.0000	0.0000	176.2105	297.9248	418.5211 (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)	456.7119	370.7072	326.0905	208.5636	118.2693	0.0000	0.0000	0.0000	0.0000	195.3553	330.2935	463.9924 (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	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991 (64)
Efficiency of water heater (217)m	87.0706	86.8936	86.4622	85.4818	83.6974	76.4000	76.4000	76.4000	76.4000	85.1038	86.4826	76.4000 (216)
Fuel for water heating, kWh/month	117.5289	102.6989	107.0336	96.8426	96.1995	92.5669	88.6492	99.8298	100.4158	102.6845	107.5802	113.7831 (219)
Water heating fuel used												1225.8130 (219)
Annual totals kWh/year												
Space heating fuel - main system												2469.9839 (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)												372.4349 (232)
Total delivered energy for all uses												4143.2318 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2469.9839	3.4800	85.9554 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1225.8130	3.4800	42.6583 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	372.4349	13.1900	49.1242 (250)
Additional standing charges			120.0000 (251)
Total energy cost			307.6304 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0460 (257)
SAP value		85.4080
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	2469.9839	0.2160	533.5165 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1225.8130	0.2160	264.7756 (264)
Space and water heating			798.2921 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.4349	0.5190	193.2937 (268)
Total kg/year			1030.5109 (272)
CO2 emissions per m2			13.1200 (273)
EI value			88.8206
EI rating			89 (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	$3.48 / 0.8283 = 4.201$, stars = 5
Water heating environmental impact	$0.216 / 0.8283 = 0.2608$, 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	39.2600 (1b)	x 2.3700 (2b)	= 93.0462 (1b) - (3b)
First floor	39.2600 (1c)	x 2.6200 (2c)	= 102.8612 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.9074 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =										40.0000 / (5) =							0.2042 (8)
Pressure test										Yes							
Measured/design AP50																	3.8300
Infiltration rate																	0.3957 (18)
Number of sides sheltered																	2 (19)
Shelter factor										(20) = 1 - [0.075 x (19)] =							0.8500 (20)
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =							0.3363 (21)
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4120	0.3868	0.3784	0.3531	0.3531	0.3447	0.3447	0.3363	0.3363	0.3616	0.3616	0.3700	(22b)				
Effective ac	0.5849	0.5748	0.5716	0.5624	0.5624	0.5594	0.5594	0.5566	0.5566	0.5654	0.5654	0.5684	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)					
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)					
Wl - Brick (Timber Frame)	46.9520	11.8870	35.0650	0.2100	7.3637	7.4000	259.4810 (29a)					
Rf - Ins Joist	39.2630		39.2630	0.0800	3.1410	7.4000	290.5462 (30)					
Total net area of external elements Aum(A, m2)			125.4710				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.0592		(33)					
Party Wall			83.4200	0.0000	0.0000	7.4000	617.3080 (32)					
Stud			74.8825			7.4000	554.1306 (32c)					
Internal Floor			39.2630			7.4000	290.5462 (32d)					
Internal Ceiling			39.2630			7.4000	290.5462 (32e)					
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	5270.8410 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							67.1274 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2130 (36)					
Total fabric heat loss						(33) + (36) =	47.2722 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	37.8116	37.1603	36.9524	36.3559	36.1663	36.1663	35.9811	35.9811	36.5502	36.5502	36.7490 (38)	
Heat transfer coeff	85.0838	84.4325	84.2246	83.6281	83.6281	83.4384	83.4384	83.2533	83.2533	83.8224	83.8224	84.0212 (39)
Average = Sum(39)m / 12 =												83.8372 (39)
HLP	Jan 1.0836	Feb 1.0753	Mar 1.0727	Apr 1.0651	May 1.0651	Jun 1.0626	Jul 1.0626	Aug 1.0603	Sep 1.0603	Oct 1.0675	Nov 1.0675	Dec 1.0701 (40)
HLP (average)												1.0677 (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												2.4342 (42)
Average daily hot water use (litres/day)												92.0118 (43)
Daily hot water use	Jan 101.2129	Feb 97.5325	Mar 93.8520	Apr 90.1715	May 86.4911	Jun 82.8106	Jul 82.8106	Aug 86.4911	Sep 90.1715	Oct 93.8520	Nov 97.5325	Dec 101.2129 (44)
Energy conte	150.0959	131.2748	135.4638	118.1007	113.3204	97.7869	90.6139	103.9808	105.2227	122.6269	133.8568	145.3598 (45)
Energy content (annual)												Total = Sum(45)m = 1447.7033 (45)
Distribution loss (46)m = 0.15 x (45)m												

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Calculation Type: New Build (As Built)

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

	22.5144	19.6912	20.3196	17.7151	16.9981	14.6680	13.5921	15.5971	15.7834	18.3940	20.0785	21.8040 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6693	0.5762	0.5721	0.4792	0.4411	0.3644	0.3377	0.4047	0.4270	0.5179	0.5875	0.6482 (61)
Total heat required for water heating calculated for each month	150.7652	131.8510	136.0359	118.5799	113.7614	98.1513	90.9516	104.3855	105.6496	123.1448	134.4443	146.0081 (62)
WWHRS	-48.4321	-42.6122	-43.4923	-35.7971	-33.2450	-27.4302	-23.2236	-28.1156	-28.9319	-35.7563	-41.4062	-46.8089 eq. (G10)
Total of WWHRS savings												-435.2513
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	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991 (64)
Heat gains from water heating, kWh/month	50.0742	43.7929	45.1848	39.3883	37.7893	32.6052	30.2135	34.6748	35.0933	40.9029	44.6543	48.4942 (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	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.7220	46.8272	38.0825	28.8309	21.5514	18.1946	19.6599	25.5547	34.2995	43.5511	50.8305	54.1873 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.8650	326.2153	317.7726	299.7991	277.1107	255.7868	241.5411	238.1908	246.6335	264.6071	287.2955	308.6193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393 (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)	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672 (71)
Water heating gains (Table 5)	67.3040	65.1680	60.7322	54.7059	50.7921	45.2851	40.6096	46.6059	48.7407	54.9770	62.0198	65.1804 (72)
Total internal gains	546.6139	541.9334	520.3101	487.0587	453.1770	422.9893	405.5335	414.0743	433.3965	466.8580	503.8686	531.7099 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W
East				7.2440	25.1733	0.7300	0.7200				0.7700	66.4212 (76)
West				2.5540	25.1733	0.7300	0.7200				0.7700	23.4179 (80)

Solar gains	89.8391	149.4989	249.8546	366.0685	422.1487	476.8123	438.8679	393.2507	305.8337	193.6690	111.6521	72.6192 (83)
Total gains	636.4530	691.4324	770.1647	853.1272	875.3257	899.8016	844.4014	807.3250	739.2303	660.5270	615.5207	604.3291 (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	17.2080	17.3407	17.3836	17.5075	17.5075	17.5473	17.5473	17.5864	17.5864	17.4670	17.4670	17.4256
alpha	2.1472	2.1560	2.1589	2.1672	2.1672	2.1698	2.1698	2.1724	2.1724	2.1645	2.1645	2.1617
util living area	0.8771	0.8540	0.7994	0.7066	0.5842	0.4188	0.3062	0.3095	0.5128	0.7171	0.8340	0.8847 (86)
MIT	18.8290	19.0436	19.5197	20.0911	20.5604	20.8564	20.9505	20.9512	20.7675	20.2484	19.5023	18.8189 (87)
Th 2	20.0143	20.0211	20.0232	20.0295	20.0295	20.0315	20.0315	20.0334	20.0334	20.0274	20.0274	20.0254 (88)
util rest of house	0.8638	0.8386	0.7781	0.6750	0.5365	0.3522	0.2230	0.2229	0.4447	0.6773	0.8133	0.8720 (89)
MIT 2	17.1666	17.4725	18.1435	18.9348	19.5569	19.9115	20.0045	20.0078	19.8237	19.1667	18.1352	17.1584 (90)
Living area fraction	17.5036	17.7910	18.4226	19.1692	19.7604	20.1031	20.1963	20.1990	20.0151	19.3861	18.4124	17.4951 (92)
MIT	17.5036	17.7910	18.4226	19.1692	19.7604	20.1031	20.1963	20.1990	20.0151	19.3861	18.4124	17.4951 (92)
Temperature adjustment	17.3536	17.6410	18.2726	19.0192	19.6104	19.9531	20.0463	20.0490	19.8651	19.2361	18.2624	17.3451 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8162	0.7904	0.7315	0.6373	0.5140	0.3465	0.2243	0.2244	0.4319	0.6394	0.7655	0.8253 (94)
Useful gains	519.5018	546.5250	563.3471	543.6634	449.8856	311.7458	189.4058	181.1680	319.2606	422.3424	471.1948	498.7709 (95)
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	991.5364	974.4369	890.4691	745.8968	544.4516	338.1865	195.7746	187.2396	363.4054	581.3966	793.1591	970.0292 (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	351.1937	287.5568	243.3788	145.6081	70.3571	0.0000	0.0000	0.0000	0.0000	118.3363	231.8143	350.6162 (98)
Space heating												1798.8612 (98)
Space heating per m2												(98) / (4) = 22.9096 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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													1994.3029 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	351.1937	287.5568	243.3788	145.6081	70.3571	0.0000	0.0000	0.0000	0.0000	118.3363	231.8143	350.6162	(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)	389.3500	318.7991	269.8213	161.4280	78.0013	0.0000	0.0000	0.0000	0.0000	131.1933	257.0003	388.7097	(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	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991	(64)
Efficiency of water heater (217)m	86.6677	86.4996	85.9243	84.6574	82.2696	76.4000	76.4000	76.4000	76.4000	83.7723	85.7633	76.4000	(216)
Fuel for water heating, kWh/month	118.0752	103.1667	107.7038	97.7857	97.8690	92.5669	88.6492	99.8298	100.4158	104.3166	108.4825	114.3577	(219)
Water heating fuel used												1233.2188	(219)
Annual totals kWh/year													
Space heating fuel - main system												1994.3029	(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)												372.4349	(232)
Total delivered energy for all uses												3674.9567	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1994.3029	5.7300	114.2736 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1233.2188	5.7300	70.6634 (247)
Pumps and fans for heating	75.0000	24.1800	18.1350 (249)
Energy for lighting	372.4349	24.1800	90.0548 (250)
Additional standing charges			114.0000 (251)
Total energy cost			407.1268 (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	1994.3029	0.2160	430.7694 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1233.2188	0.2160	266.3753 (264)
Space and water heating			697.1447 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.4349	0.5190	193.2937 (268)
Total kg/year			929.3634 (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	1994.3029	1.2200	2433.0496 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1233.2188	1.2200	1504.5270 (264)
Space and water heating			3937.5765 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	372.4349	3.0700	1143.3752 (268)
Primary energy kWh/year			5311.2017 (272)
Primary energy kWh/m2/year			67.6414 (273)

SAP 2012 EPC IMPROVEMENTS

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

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
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	SAP increase too small
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Recommended
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
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 10.8	-£ 471	-1010 kg (108.7%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.9	-£ 32	-142 kg (15.3%)
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Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar photovoltaic panels	£471	12.87 kg/m²	A 96	A 99
Total Savings	£471	12.87 kg/m²		
Potential energy efficiency rating:			A 96	
Potential environmental impact rating:				A 99

Fuel prices for cost data on this page from database revision number 568 TEST (31 Mar 2025)
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	£108	£108	£0
Mains gas	£299	£299	£0
Space heating	£246	£246	£0
Water heating	£71	£71	£0
Lighting	£90	£90	£0
Generated (PV)	-£0	-£471	£471
Total cost of fuels	£407	-£64	£471
Total cost of uses	£407	-£64	£471
Delivered energy	47 kWh/m²	22 kWh/m²	25 kWh/m²
Carbon dioxide emissions	0.9 tonnes	-0.1 tonnes	1.0 tonnes
CO2 emissions per m²	12 kg/m²	-1 kg/m²	13 kg/m²
Primary energy	68 kWh/m²	-8 kWh/m²	76 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	39.2600 (1b)	x 2.3700 (2b)	= 93.0462 (1b) - (3b)
First floor	39.2600 (1c)	x 2.6200 (2c)	= 102.8612 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.9074 (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) = 0.2042 (8)
Pressure test					Yes
Measured/design AP50					3.8300
Infiltration rate					0.3957 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3363 (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	0.4288	0.4204	0.4120	0.3700	0.3616	0.3195	0.3195	0.3111	0.3363	0.3616	0.3784	0.3952 (22b)
Effective ac	0.5919	0.5884	0.5849	0.5684	0.5654	0.5510	0.5510	0.5484	0.5566	0.5654	0.5716	0.5781 (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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	46.9520	11.8870	35.0650	0.2100	7.3637	7.4000	259.4810 (29a)
Rf - Ins Joist	39.2630		39.2630	0.0800	3.1410	7.4000	290.5462 (30)
Total net area of external elements Aum(A, m ²)			125.4710				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	33.0592		(33)
Party Wall			83.4200	0.0000	0.0000	7.4000	617.3080 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2130 (36)
Total fabric heat loss							(33) + (36) = 47.2722 (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	38.2687	38.0379	37.8116	36.7490	36.5502	35.6246	35.6246	35.4532	35.9811	36.5502	36.9524	37.3729 (38)
Heat transfer coeff	85.5409	85.3101	85.0838	84.0212	83.8224	82.8968	82.8968	82.7254	83.2533	83.8224	84.2246	84.6451 (39)
Average = Sum(39)m / 12 =												84.0202 (39)
HLP	1.0894	1.0865	1.0836	1.0701	1.0675	1.0557	1.0557	1.0536	1.0603	1.0675	1.0727	1.0780 (40)
HLP (average)												1.0700 (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												2.4342 (42)
Average daily hot water use (litres/day)												92.0118 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	101.2129	97.5325	93.8520	90.1715	86.4911	82.8106	82.8106	86.4911	90.1715	93.8520	97.5325	101.2129 (44)
Energy content (annual)	150.0959	131.2748	135.4638	118.1007	113.3204	97.7869	90.6139	103.9808	105.2227	122.6269	133.8568	145.3598 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1447.7033 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	22.5144	19.6912	20.3196	17.7151	16.9981	14.6680	13.5921	15.5971	15.7834	18.3940	20.0785	21.8040 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6693	0.5762	0.5721	0.4792	0.4411	0.3644	0.3377	0.4047	0.4270	0.5179	0.5875	0.6482 (61)
Total heat required for water heating calculated for each month	150.7652	131.8510	136.0359	118.5799	113.7614	98.1513	90.9516	104.3855	105.6496	123.1448	134.4443	146.0081 (62)
WWHRS	-48.4321	-42.6122	-43.4923	-35.7971	-33.2450	-27.4302	-23.2236	-28.1156	-28.9319	-35.7563	-41.4062	-46.8089 eq. (G10)
Total of WWHRS savings												-435.2513
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	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991 (64)
Heat gains from water heating, kWh/month	50.0742	43.7929	45.1848	39.3883	37.7893	32.6052	30.2135	34.6748	35.0933	40.9029	44.6543	48.4942 (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	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.7220	46.8272	38.0825	28.8309	21.5514	18.1946	19.6599	25.5547	34.2995	43.5511	50.8305	54.1873 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.8650	326.2153	317.7726	299.7991	277.1107	255.7868	241.5411	238.1908	246.6335	264.6071	287.2955	308.6193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393 (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)	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672 (71)
Water heating gains (Table 5)	67.3040	65.1680	60.7322	54.7059	50.7921	45.2851	40.6096	46.6059	48.7407	54.9770	62.0198	65.1804 (72)
Total internal gains	546.6139	541.9334	520.3101	487.0587	453.1770	422.9893	405.5335	414.0743	433.3965	466.8580	503.8686	531.7099 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
East					7.2440	19.6403	0.7300	0.7200	0.7700		51.8220 (76)	
West					2.5540	19.6403	0.7300	0.7200	0.7700		18.2708 (80)	

Solar gains	70.0928	137.1164	225.8111	329.3321	403.6088	413.1654	393.3503	337.8821	262.6277	162.7001	87.3975	57.6409 (83)
Total gains	616.7067	679.0498	746.1212	816.3908	856.7858	836.1547	798.8839	751.9564	696.0242	629.5581	591.2661	589.3508 (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	17.1161	17.1624	17.2080	17.4256	17.4670	17.6620	17.6620	17.6986	17.5864	17.4670	17.3836	17.2972
alpha	2.1411	2.1442	2.1472	2.1617	2.1645	2.1775	2.1775	2.1799	2.1724	2.1645	2.1589	2.1531
util living area	0.8987	0.8747	0.8311	0.7549	0.6511	0.5218	0.4075	0.4421	0.6170	0.7864	0.8719	0.9063 (86)
MIT	18.4537	18.7267	19.2082	19.8240	20.3481	20.7215	20.8841	20.8577	20.5723	19.8923	19.0776	18.4009 (87)
Th 2	20.0095	20.0119	20.0143	20.0254	20.0274	20.0371	20.0371	20.0389	20.0334	20.0274	20.0232	20.0188 (88)
util rest of house	0.8882	0.8619	0.8135	0.7286	0.6117	0.4638	0.3314	0.3658	0.5622	0.7576	0.8568	0.8966 (89)
MIT 2	16.6262	17.0157	17.7003	18.5671	19.2802	19.7653	19.9500	19.9267	19.5908	18.6819	17.5302	16.5546 (90)
Living area fraction	16.9967	17.3626	18.0060	18.8219	19.4968	19.9591	20.1394	20.1155	19.7898	18.9273	17.8439	16.9289 (92)
MIT	16.9967	17.3626	18.0060	18.8219	19.4968	19.9591	20.1394	20.1155	19.7898	18.9273	17.8439	16.9289 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8467	17.2126	17.8560	18.6719	19.3468	19.8091	19.9894	19.9655	19.6398	18.7773	17.6939	16.7789 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	519.5533	552.8069	570.8719	559.7650	497.5837	375.3780	261.5483	270.3951	373.9077	448.5962	478.4848	502.2162 (94)
Ext temp.	4.3000	4.9000	6.5000	8.0000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1073.2551	1050.3931	966.2128	821.0489	640.9693	431.8216	280.9671	294.9546	461.2069	685.4383	892.2692	1064.7446 (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	411.9542	334.3779	294.1337	188.1244	106.6789	0.0000	0.0000	0.0000	0.0000	176.2105	297.9248	418.5211 (98)
Space heating												2227.9255 (98)
Space heating per m2												(98) / (4) = 28.3740 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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												2469.9839	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	411.9542	334.3779	294.1337	188.1244	106.6789	0.0000	0.0000	0.0000	0.0000	176.2105	297.9248	418.5211	(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)	456.7119	370.7072	326.0905	208.5636	118.2693	0.0000	0.0000	0.0000	0.0000	195.3553	330.2935	463.9924	(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	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991	(64)
Efficiency of water heater (217)m	87.0706	86.8936	86.4622	85.4818	83.6974	76.4000	76.4000	76.4000	76.4000	85.1038	86.4826	76.4000	(216)
Fuel for water heating, kWh/month	117.5289	102.6989	107.0336	96.8426	96.1995	92.5669	88.6492	99.8298	100.4158	102.6845	107.5802	113.7831	(219)
Water heating fuel used												1225.8130	(219)
Annual totals kWh/year													
Space heating fuel - main system												2469.9839	(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)												372.4349	(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												2415.9924	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2469.9839	3.4800	85.9554 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1225.8130	3.4800	42.6583 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	372.4349	13.1900	49.1242 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			79.8075 (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] =	0.2714 (257)
SAP value	96.2144	
SAP rating (Section 12)	96	(258)
SAP band	A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2469.9839	0.2160	533.5165	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1225.8130	0.2160	264.7756	(264)
Space and water heating			798.2921	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	372.4349	0.5190	193.2937	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			134.0736	(272)
CO2 emissions per m2			1.7100	(273)
EI value			98.5455	
EI rating			99	(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	39.2600 (1b)	x 2.3700 (2b)	= 93.0462 (1b) - (3b)
First floor	39.2600 (1c)	x 2.6200 (2c)	= 102.8612 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	78.5200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 195.9074 (5)

2. Ventilation rate

										main	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																4 * 10 =	40.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000	/ (5) =	0.2042 (8)
Pressure test										Yes							
Measured/design AP50										3.8300							
Infiltration rate										0.3957 (18)							
Number of sides sheltered										2 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.8500 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3363 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec					
Wind factor	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)				
Adj infilt rate	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)				
	0.4120	0.3868	0.3784	0.3531	0.3531	0.3447	0.3447	0.3363	0.3363	0.3616	0.3616	0.3700	(22b)				
Effective ac	0.5849	0.5748	0.5716	0.5624	0.5624	0.5594	0.5594	0.5566	0.5566	0.5654	0.5654	0.5684	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
Solid Door			2.0900	1.2000	2.5080		(26)					
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)					
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)					
Wl - Brick (Timber Frame)	46.9520	11.8870	35.0650	0.2100	7.3637	7.4000	259.4810 (29a)					
Rf - Ins Joist	39.2630		39.2630	0.0800	3.1410	7.4000	290.5462 (30)					
Total net area of external elements Aum(A, m2)			125.4710				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	33.0592		(33)					
Party Wall			83.4200	0.0000	0.0000	7.4000	617.3080 (32)					
Stud			74.8825			7.4000	554.1306 (32c)					
Internal Floor			39.2630			7.4000	290.5462 (32d)					
Internal Ceiling			39.2630			7.4000	290.5462 (32e)					
Heat capacity Cm = Sum(A x k)							(28) ... (30) + (32) + (32a) ... (32e) = 5270.8410 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							67.1274 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.2130 (36)					
Total fabric heat loss							(33) + (36) = 47.2722 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	37.8116	37.1603	36.9524	36.3559	36.1663	36.1663	35.9811	35.9811	36.5502	36.5502	36.7490 (38)	
Heat transfer coeff	85.0838	84.4325	84.2246	83.6281	83.6281	83.4384	83.4384	83.2533	83.2533	83.8224	83.8224	84.0212 (39)
Average = Sum(39)m / 12 =												83.8372 (39)
HLP	Jan 1.0836	Feb 1.0753	Mar 1.0727	Apr 1.0651	May 1.0651	Jun 1.0626	Jul 1.0626	Aug 1.0603	Sep 1.0603	Oct 1.0675	Nov 1.0675	Dec 1.0701 (40)
HLP (average)												1.0677 (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												2.4342 (42)
Average daily hot water use (litres/day)												92.0118 (43)
Daily hot water use	Jan 101.2129	Feb 97.5325	Mar 93.8520	Apr 90.1715	May 86.4911	Jun 82.8106	Jul 82.8106	Aug 86.4911	Sep 90.1715	Oct 93.8520	Nov 97.5325	Dec 101.2129 (44)
Energy conte	150.0959	131.2748	135.4638	118.1007	113.3204	97.7869	90.6139	103.9808	105.2227	122.6269	133.8568	145.3598 (45)
Energy content (annual)												Total = Sum(45)m = 1447.7033 (45)
Distribution loss (46)m = 0.15 x (45)m												

Water storage loss:	22.5144	19.6912	20.3196	17.7151	16.9981	14.6680	13.5921	15.5971	15.7834	18.3940	20.0785	21.8040 (46)
Total storage loss												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	0.6693	0.5762	0.5721	0.4792	0.4411	0.3644	0.3377	0.4047	0.4270	0.5179	0.5875	0.6482 (61)
Total heat required for water heating calculated for each month												
	150.7652	131.8510	136.0359	118.5799	113.7614	98.1513	90.9516	104.3855	105.6496	123.1448	134.4443	146.0081 (62)
WWHRS	-48.4321	-42.6122	-43.4923	-35.7971	-33.2450	-27.4302	-23.2236	-28.1156	-28.9319	-35.7563	-41.4062	-46.8089 eq. (G10)
Total of WWHRS savings												-435.2513
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input	(sum of months) =	Sum(63)m =		0.0000 (63)
Output from w/h												
	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991 (64)
								Total per year (kWh/year) =	Sum(64)m =			1018.4772 (64)
Heat gains from water heating, kWh/month												
	50.0742	43.7929	45.1848	39.3883	37.7893	32.6052	30.2135	34.6748	35.0933	40.9029	44.6543	48.4942 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.7220	46.8272	38.0825	28.8309	21.5514	18.1946	19.6599	25.5547	34.2995	43.5511	50.8305	54.1873 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.8650	326.2153	317.7726	299.7991	277.1107	255.7868	241.5411	238.1908	246.6335	264.6071	287.2955	308.6193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393 (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)	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672 (71)
Water heating gains (Table 5)	67.3040	65.1680	60.7322	54.7059	50.7921	45.2851	40.6096	46.6059	48.7407	54.9770	62.0198	65.1804 (72)
Total internal gains	546.6139	541.9334	520.3101	487.0587	453.1770	422.9893	405.5335	414.0743	433.3965	466.8580	503.8686	531.7099 (73)

[Jan					Area	Solar flux	g		FF	Access		Gains
					m2	Table 6a	Specific data		Specific data	factor		W
						W/m2	or Table 6b		or Table 6c	Table 6d		
East					7.2440	25.1733	0.7300		0.7200	0.7700		66.4212
West					2.5540	25.1733	0.7300		0.7200	0.7700		(76)
Solar gains	89.8391	149.4989	249.8546	366.0685	422.1487	476.8123	438.8679	393.2507	305.8337	193.6690	111.6521	72.6192 (83)
Total gains	636.4530	691.4324	770.1647	853.1272	875.3257	899.8016	844.4014	807.3250	739.2303	660.5270	615.5207	604.3291 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nll,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	17.2080	17.3407	17.3836	17.5075	17.5075	17.5473	17.5473	17.5864	17.5864	17.4670	17.4670	17.4256
alpha	2.1472	2.1560	2.1589	2.1672	2.1672	2.1698	2.1698	2.1724	2.1724	2.1645	2.1645	2.1617
util living area	0.8771	0.8540	0.7994	0.7066	0.5842	0.4188	0.3062	0.3095	0.5128	0.7171	0.8340	0.8847 (86)
MIT	18.8290	19.0436	19.5197	20.0911	20.5604	20.8564	20.9505	20.9512	20.7675	20.2484	19.5023	18.8189 (87)
Th 2	20.0143	20.0211	20.0232	20.0295	20.0295	20.0315	20.0315	20.0334	20.0334	20.0274	20.0274	20.0254 (88)
util rest of house	0.8638	0.8386	0.7781	0.6750	0.5365	0.3522	0.2230	0.2229	0.4447	0.6773	0.8133	0.8720 (89)
MIT 2	17.1666	17.4725	18.1435	18.9348	19.5569	19.9115	20.0045	20.0078	19.8237	19.1667	18.1352	17.1584 (90)
Living area fraction												0.2028 (91)
MIT	17.5036	17.7910	18.4226	19.1692	19.7604	20.1031	20.1963	20.1990	20.0151	19.3861	18.4124	17.4951 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.3536	17.6410	18.2726	19.0192	19.6104	19.9531	20.0463	20.0490	19.8651	19.2361	18.2624	17.3451 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8162	0.7904	0.7315	0.6373	0.5140	0.3465	0.2243	0.2244	0.4319	0.6394	0.7655	0.8253 (94)
Useful gains	519.5018	546.5250	563.3471	543.6634	449.8856	311.7458	189.4058	181.1680	319.2606	422.3424	471.1948	498.7709 (95)
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												
	991.5364	974.4369	890.4691	745.8968	544.4516	338.1865	195.7746	187.2396	363.4054	581.3966	793.1591	970.0292 (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												
	351.1937	287.5568	243.3788	145.6081	70.3571	0.0000	0.0000	0.0000	0.0000	118.3363	231.8143	350.6162 (98)
Space heating												1798.8612 (98)
Space heating per m2												22.9096 (99)
										(98) / (4) =		

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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												1994.3029	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	351.1937	287.5568	243.3788	145.6081	70.3571	0.0000	0.0000	0.0000	0.0000	118.3363	231.8143	350.6162	(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)	389.3500	318.7991	269.8213	161.4280	78.0013	0.0000	0.0000	0.0000	0.0000	131.1933	257.0003	388.7097	(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	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991	(64)
Efficiency of water heater	86.6677	86.4996	85.9243	84.6574	82.2696	76.4000	76.4000	76.4000	76.4000	83.7723	85.7633	76.4000	(216)
(217)m												86.7446	(217)
Fuel for water heating, kWh/month	118.0752	103.1667	107.7038	97.7857	97.8690	92.5669	88.6492	99.8298	100.4158	104.3166	108.4825	114.3577	(219)
Water heating fuel used												1233.2188	(219)
Annual totals kWh/year													
Space heating fuel - main system												1994.3029	(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)												372.4349	(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												1728.5107	(238)

10a. Fuel costs - using BEDF prices (568)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1994.3029	5.7300	114.2736 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1233.2188	5.7300	70.6634 (247)
Pumps and fans for heating	75.0000	24.1800	18.1350 (249)
Energy for lighting	372.4349	24.1800	90.0548 (250)
Additional standing charges			114.0000 (251)
Energy saving/generation technologies			
PV Unit	-1946.4459	24.1800	-470.6506 (252)
Total energy cost			-63.5239 (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	1994.3029	0.2160	430.7694 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1233.2188	0.2160	266.3753 (264)
Space and water heating			697.1447 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.4349	0.5190	193.2937 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	0.5190	-1010.2054 (269)
Total kg/year			-80.8420 (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	1994.3029	1.2200	2433.0496 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1233.2188	1.2200	1504.5270 (264)
Space and water heating			3937.5765 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	372.4349	3.0700	1143.3752 (268)
Energy saving/generation technologies			
PV Unit	-1946.4459	3.0700	-5975.5890 (269)
Primary energy kWh/year			-664.3873 (272)
Primary energy kWh/m2/year			-8.4614 (273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	080 - PRJ013014	Issued on Date	14/04/2025
Assessment Reference	080	Prop Type Ref	E
Property	7 Erwood Close, Netley Abbey, Southampton, SO31 5TJ		
SAP Rating	85 B	DER	14.17
Environmental	89 B	TER	17.19
CO ₂ Emissions (t/year)	0.93	% DER<TER	17.55
General Requirements Compliance	Pass	DFEE	39.85
		TFEE	44.14
		% DFEE<TFEE	9.73
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk		Assessor ID
			4299-0004
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)	17.19	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.17	kgCO ₂ /m ²	Pass
	-3.02 (-17.6%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	44.14	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	39.85	kWh/m ² /yr	
	-4.3 (-9.8%)	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
Party wall	0.00 (max. 0.20)	-	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	1.36 (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	3.83 (measured in this dwelling)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

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

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 East

7.24 m², No overhang

Windows facing West

2.55 m², No overhang

Air change rate

4.70 ach

Blinds/curtains

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

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type

U-value

Filled Cavity with Edge Sealing

0.00

W/m²K

Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals

3.83 (measured in this dwelling)

Maximum

10.0

Pass

10 Key features

Party wall U-value

0.00

W/m²K

Roof U-value

0.08

W/m²K

Air permeability

3.8

m³/m²h

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