

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	006 - PRJ013014			Issued on Date	30/11/2023
Assessment Reference	006	Prop Type Ref	E		
Property	6 Rashleigh Drive, Netley Abbey, Southampton, SO31 5JY				
SAP Rating	85 B	DER	14.83	TER	17.77
Environmental	88 B	% DER<TER	16.57		
CO ₂ Emissions (t/year)	0.98	DFEE	42.80	TFEE	46.95
General Requirements Compliance	Pass	% DFEE<TFEE	8.84		
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) 17.77 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.83 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 46.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 42.8 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: 4.65 (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: 2.55 m², No overhang
Windows facing South: 7.24 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

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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					4.6500
Infiltration rate					0.4367 (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) =	0.3712 (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	0.4732	0.4640	0.4547	0.4083	0.3990	0.3526	0.3526	0.3433	0.3712	0.3990	0.4176	0.4361 (22b)
Effective ac	0.6120	0.6076	0.6034	0.5834	0.5796	0.5622	0.5622	0.5589	0.5689	0.5796	0.5872	0.5951 (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			39.2600	0.1800	7.0668	75.6000	2968.0560 (28a)
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.2100	12.7602	7.4000	449.6462 (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)			151.1660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.4552		(33)
Party Wall			57.7220	0.0000	0.0000	7.4000	427.1428 (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) = 5270.6142 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1245 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.7642 (36)
Total fabric heat loss							(33) + (36) = 55.2194 (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	39.5643	39.2832	39.0077	37.7134	37.4712	36.3439	36.3439	36.1352	36.7782	37.4712	37.9611	38.4732 (38)
Heat transfer coeff	94.7838	94.5027	94.2271	92.9328	92.6907	91.5634	91.5634	91.3546	91.9976	92.6907	93.1805	93.6927 (39)
Average = Sum(39)m / 12 =												92.9317 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2071	1.2035	1.2000	1.1836	1.1805	1.1661	1.1661	1.1635	1.1716	1.1805	1.1867	1.1932 (40)
HLP (average)												1.1835 (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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	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												

	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								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
	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)	

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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												3096.6202 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	503.7737	406.6649	368.0395	252.9855	159.1156	0.0000	0.0000	0.0000	0.0000	224.0655	367.0913	511.4154 (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)	558.5074	450.8480	408.0261	280.4717	176.4031	0.0000	0.0000	0.0000	0.0000	248.4097	406.9749	566.9793 (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	87.5306	87.3604	87.0410	86.3543	85.0389	76.4000	76.4000	76.4000	76.4000	85.8491	87.0217	76.4000 (216)
Fuel for water heating, kWh/month	116.9112	102.1502	106.3219	95.8641	94.6819	92.5669	88.6492	99.8298	100.4158	101.7931	106.9137	113.2041 (219)
Water heating fuel used												1219.3018 (219)
Annual totals kWh/year												
Space heating fuel - main system												3096.6202 (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												4763.3569 (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	3096.6202	0.2160	668.8700 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1219.3018	0.2160	263.3692 (264)
Space and water heating			932.2391 (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			1164.4579 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.8300 (273)

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

DER		14.8300 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		33.4149 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		33.4149 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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					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) = 0.1531 (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 m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.0900	1.0000	2.0900		(26)
TER Opening Type (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2600	0.1300	5.1038		(28a)
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.1800	10.9373		(29a)
Rf - Ins Joist	39.2630		39.2630	0.1300	5.1042		(30)
Total net area of external elements Aum(A, m ²)			151.1660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.2145		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8715 (36)
Total fabric heat loss						(33) + (36) =	47.0860 (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	38.4948	38.2552	38.0204	36.9173	36.7109	35.7502	35.7502	35.5723	36.1202	36.7109	37.1284	37.5649 (38)
Heat transfer coeff	85.5808	85.3412	85.1064	84.0033	83.7969	82.8362	82.8362	82.6583	83.2062	83.7969	84.2144	84.6509 (39)
Average = Sum(39)m / 12 =												84.0023 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0899	1.0869	1.0839	1.0698	1.0672	1.0550	1.0550	1.0527	1.0597	1.0672	1.0725	1.0781 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	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												
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												
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

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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
North					2.5540	10.6334	0.6300	0.7000			0.7700	8.2997 (74)
South					7.2440	46.7521	0.6300	0.7000			0.7700	103.5026 (78)
Solar gains	111.8023	185.3717	242.8784	287.3356	312.6268	307.1688	297.4110	278.4657	257.9657	201.7137	132.9246	96.3548 (83)
Total gains	496.0580	566.9515	610.2377	632.2982	634.9323	607.7206	584.3456	572.1323	563.5614	529.9163	486.9015	469.5391 (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	63.7150	63.8938	64.0702	64.9115	65.0713	65.8260	65.8260	65.9677	65.5333	65.0713	64.7487	64.4149	
alpha	5.2477	5.2596	5.2713	5.3274	5.3381	5.3884	5.3884	5.3978	5.3689	5.3381	5.3166	5.2943	
util living area	0.9975	0.9944	0.9875	0.9683	0.9147	0.7807	0.6043	0.6381	0.8507	0.9712	0.9945	0.9981	(86)
MIT	19.8700	20.0196	20.2356	20.5094	20.7589	20.9322	20.9862	20.9815	20.8848	20.5667	20.1673	19.8444	(87)
Th 2	20.0091	20.0116	20.0140	20.0255	20.0277	20.0378	20.0378	20.0396	20.0339	20.0277	20.0233	20.0188	(88)
util rest of house	0.9966	0.9925	0.9831	0.9559	0.8792	0.6964	0.4821	0.5179	0.7824	0.9576	0.9923	0.9975	(89)
MIT 2	18.5035	18.7233	19.0384	19.4386	19.7793	19.9892	20.0323	20.0316	19.9398	19.5251	18.9480	18.4732	(90)
Living area fraction	18.7806	18.9861	19.2811	19.6557	19.9779	20.1804	20.2257	20.2242	20.1314	19.7363	19.1952	18.7512	(91)
MIT	18.7806	18.9861	19.2811	19.6557	19.9779	20.1804	20.2257	20.2242	20.1314	19.7363	19.1952	18.7512	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7806	18.9861	19.2811	19.6557	19.9779	20.1804	20.2257	20.2242	20.1314	19.7363	19.1952	18.7512	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	493.6130	561.1480	597.1635	600.6450	556.8266	431.5845	296.2387	310.2180	445.3942	504.5700	481.8322	467.7744	(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	1239.2595	1202.1279	1087.7524	903.5159	693.6661	462.2602	300.3402	316.1013	501.8521	765.5913	1018.5892	1231.7713	(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	554.7610	430.7385	364.9982	218.0671	101.8086	0.0000	0.0000	0.0000	0.0000	194.1998	386.4650	568.4137	(98)
Space heating												2819.4517	(98)
Space heating per m2												35.9074	(99)

8c. Space cooling requirement

Not applicable

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

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Calculation Type: New Build (As Built)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3018.6849 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	554.7610	430.7385	364.9982	218.0671	101.8086	0.0000	0.0000	0.0000	0.0000	194.1998	386.4650	568.4137	(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)	593.9625	461.1761	390.7903	233.4765	109.0028	0.0000	0.0000	0.0000	0.0000	207.9227	413.7741	608.5799	(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	87.4733	87.2158	86.7523	85.7913	83.9855	80.3000	80.3000	80.3000	80.3000	85.3802	86.9011	87.5724	(217)
Fuel for water heating, kWh/month	229.8470	201.9892	211.2794	189.4933	187.4076	172.6338	165.3964	184.3782	186.4144	199.6398	209.3816	224.1789	(219)
Water heating fuel used												2362.0396	(219)
Annual totals kWh/year													
Space heating fuel - main system												3018.6849	(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												5830.4942	(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	3018.6849	0.2160	652.0359 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2362.0396	0.2160	510.2006 (264)
Space and water heating			1162.2365 (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			1395.6669 (272)
Emissions per m2 for space and water heating			14.8018 (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) = (14.8018 * 1.00) + 2.4771 + 0.4957, rounded to 2 d.p.			17.7700 (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	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					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) = 0.1531 (8)
Pressure test					Yes
Measured/design AP50					4.6500
Infiltration rate					0.3856 (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) =				0.3278 (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	0.4179	0.4097	0.4015	0.3606	0.3524	0.3114	0.3114	0.3032	0.3278	0.3524	0.3688	0.3852 (22b)
Effective ac	0.5873	0.5839	0.5806	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			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2600	0.1800	7.0668	75.6000	2968.0560 (28a)
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.2100	12.7602	7.4000	449.6462 (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)			151.1660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.4552		(33)
Party Wall			57.7220	0.0000	0.0000	7.4000	427.1428 (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) =	5270.6142 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1245 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.7642 (36)
Total fabric heat loss						(33) + (36) =	55.2194 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	37.9707	37.7515	37.5366	36.5272	36.3384	35.4592	35.4592	35.2964	35.7979	36.3384	36.7204	37.1198 (38)
Heat transfer coeff	93.1902	92.9709	92.7560	91.7467	91.5578	90.6787	90.6787	90.5159	91.0173	91.5578	91.9399	92.3393 (39)
Average = Sum(39)m / 12 =												91.7458 (39)
HLP	1.1868	1.1840	1.1813	1.1684	1.1660	1.1548	1.1548	1.1528	1.1592	1.1660	1.1709	1.1760 (40)
HLP (average)												1.1684 (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	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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Water 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 (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)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	31.8954	27.8959	28.7861	25.0964	24.0806	20.7797	19.2555	22.0959	22.3598	26.0582	28.4446	30.8890 (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	21.0888	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	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)	-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)	42.8701	41.5117	38.6909	34.8561	32.3664	28.8607	25.8810	29.6988	31.0553	35.0245	39.5063	41.5174	(72)
Total internal gains	339.7912	338.3196	326.3443	306.7665	286.1638	267.0284	255.0902	259.0212	269.5323	289.2443	311.8392	329.4800	(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					2.5540	10.6334	0.7300	0.7200			0.7700			9.8919
South					7.2440	46.7521	0.7300	0.7200			0.7700			123.3581 (78)
Solar gains	133.2501	220.9329	289.4714	342.4571	372.6001	366.0951	354.4654	331.8857	307.4530	240.4098	158.4244	114.8392 (83)		
Total gains	473.0413	559.2525	615.8157	649.2236	658.7639	633.1235	609.5556	590.9069	576.9853	529.6542	470.2637	444.3192 (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	15.7104	15.7475	15.7840	15.9576	15.9905	16.1456	16.1456	16.1746	16.0855	15.9905	15.9241	15.8552	
alpha	2.0474	2.0498	2.0523	2.0638	2.0660	2.0764	2.0764	2.0783	2.0724	2.0660	2.0616	2.0570	
util living area	0.9376	0.9124	0.8798	0.8299	0.7555	0.6451	0.5258	0.5522	0.7026	0.8417	0.9156	0.9443	(86)
MIT	17.8936	18.2425	18.7525	19.3924	20.0034	20.5135	20.7779	20.7448	20.3711	19.5737	18.6181	17.8258	(87)
Th 2	19.9305	19.9328	19.9350	19.9453	19.9473	19.9563	19.9563	19.9580	19.9528	19.9473	19.9433	19.9393	(88)
util rest of house	0.9302	0.9023	0.8653	0.8074	0.7186	0.5824	0.4323	0.4620	0.6472	0.8164	0.9041	0.9377	(89)
MIT 2	17.0926	17.4368	17.9389	18.5689	19.1537	19.6252	19.8407	19.8189	19.5029	18.7547	17.8194	17.0316	(90)
Living area fraction									fLA = Living area / (4) =			0.2028	(91)
MIT	17.2550	17.6002	18.1039	18.7359	19.3260	19.8053	20.0307	20.0067	19.6789	18.9207	17.9813	17.1926	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.2550	17.6002	18.1039	18.7359	19.3260	19.8053	20.0307	20.0067	19.6789	18.9207	17.9813	17.1926	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	428.2104	488.3729	513.4201	503.9290	456.6752	362.2627	267.9563	275.7239	363.8281	416.2895	411.9157	406.2315	(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	1207.2794	1180.7461	1076.3287	902.4080	698.2195	472.0104	311.0914	326.4598	507.7790	761.8288	1000.4261	1199.7300	(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	579.6274	465.2748	418.8040	286.9049	179.7089	0.0000	0.0000	0.0000	0.0000	257.0812	423.7275	590.3629	(98)
Space heating												3201.4916	(98)
Space heating per m2												40.7729	(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	852.3795	671.0221	687.9206	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.6665	0.7329	0.7173	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	568.1305	491.8069	493.4705	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	831.4683	802.1151	782.0855	0.0000	0.0000	0.0000	0.0000	(103)

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Month fraction	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	189.6032	230.8693	214.7296	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												635.2021 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	47.4008	57.7173	53.6824	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												158.8005 (107)
Space cooling per m2												2.0224 (108)
Energy for space heating												40.7729 (99)
Energy for space cooling												2.0224 (108)
Total												42.7954 (109)
Dwelling Fabric Energy Efficiency (DFEE)												42.8 (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	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																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			39.2600	0.1300	5.1038		(28a)					
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.1800	10.9373		(29a)					
Rf - Ins Joist	39.2630		39.2630	0.1300	5.1042		(30)					
Total net area of external elements Aum(A, m2)			151.1660				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	36.2145		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.8715 (36)					
Total fabric heat loss						(33) + (36) =	47.0860 (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	85.5808	85.3412	85.1064	84.0033	83.7969	82.8362	82.8362	82.6583	83.2062	83.7969	84.2144	84.6509 (39)
Average = Sum(39)m / 12 =												84.0023 (39)
HLP	Jan 1.0899	Feb 1.0869	Mar 1.0839	Apr 1.0698	May 1.0672	Jun 1.0550	Jul 1.0550	Aug 1.0527	Sep 1.0597	Oct 1.0672	Nov 1.0725	Dec 1.0781 (40)
HLP (average)												1.0698 (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	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												

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Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Heat gains from water heating, kWh/month	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
	31.8954	27.8959	28.7861	25.0964	24.0806	20.7797	19.2555	22.0959	22.3598	26.0582	28.4446	30.8890 (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	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)	-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)	42.8701	41.5117	38.6909	34.8561	32.3664	28.8607	25.8810	29.6988	31.0553	35.0245	39.5063	41.5174	(72)
Total internal gains	339.9234	338.4370	326.4398	306.8388	286.2178	267.0740	255.1395	259.0853	269.6183	289.3535	311.9667	329.6159	(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					2.5540	10.6334	0.6300	0.7000	0.7700	8.2997 (74)		
South					7.2440	46.7521	0.6300	0.7000	0.7700	103.5026 (78)		
Solar gains	111.8023	185.3717	242.8784	287.3356	312.6268	307.1688	297.4110	278.4657	257.9657	201.7137	132.9246	96.3548 (83)
Total gains	451.7257	523.8088	569.3182	594.1744	598.8447	574.2429	552.5506	537.5511	527.5840	491.0673	444.8913	425.9707 (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	63.7150	63.8938	64.0702	64.9115	65.0713	65.8260	65.8260	65.9677	65.5333	65.0713	64.7487	64.4149	
alpha	5.2477	5.2596	5.2713	5.3274	5.3381	5.3884	5.3884	5.3978	5.3689	5.3381	5.3166	5.2943	
util living area	0.9984	0.9961	0.9908	0.9754	0.9301	0.8079	0.6340	0.6715	0.8763	0.9790	0.9964	0.9988	(86)
MIT	19.8170	19.9688	20.1889	20.4697	20.7300	20.9194	20.9827	20.9765	20.8641	20.5255	20.1176	19.7921	(87)
Th 2	20.0091	20.0116	20.0140	20.0255	20.0277	20.0378	20.0378	20.0396	20.0339	20.0277	20.0233	20.0188	(88)
util rest of house	0.9978	0.9948	0.9874	0.9654	0.8990	0.7264	0.5083	0.5487	0.8138	0.9686	0.9949	0.9984	(89)
MIT 2	18.9284	19.0816	19.3022	19.5874	19.8341	19.9972	20.0330	20.0324	19.9556	19.6459	19.2400	18.9113	(90)
Living area fraction	19.1085	19.2615	19.4820	19.7663	20.0157	20.1842	20.2256	20.2239	fLA = Living area / (4) =			0.2028	(91)
MIT	19.1085	19.2615	19.4820	19.7663	20.0157	20.1842	20.2256	20.2239	20.1398	19.8243	19.4179	19.0899	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1085	19.2615	19.4820	19.7663	20.0157	20.1842	20.2256	20.2239	20.1398	19.8243	19.4179	19.0899	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	450.4281	520.3621	560.8106	571.6245	538.0946	425.1109	295.0883	308.4074	433.5636	474.2179	442.0579	425.0663	(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	1267.3275	1225.6276	1104.8493	912.8048	696.8303	462.5747	300.3268	316.0732	502.5456	772.9641	1037.3458	1260.4428	(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	607.7731	473.9384	404.7649	245.6499	118.0994	0.0000	0.0000	0.0000	0.0000	222.2671	428.6073	621.5201	(98)
Space heating												3122.6202	(98)
Space heating per m2												39.7685	(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	778.6600	612.9876	628.2027	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8346	0.9093	0.8950	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	649.8744	557.3820	562.2531	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	762.7075	735.5514	719.8068	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	81.2399	132.5580	117.2200	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												331.0179	(104)
Cooled fraction												1.0000	(105)

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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	20.3100	33.1395	29.3050	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											82.7545 (107)
Space cooling per m2											1.0539 (108)
Energy for space heating											39.7685 (99)
Energy for space cooling											1.0539 (108)
Total											40.8224 (109)
Target Fabric Energy Efficiency (TFEE)											46.9 (109)

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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 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					4.6500
Infiltration rate					0.4367 (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) =	0.3712 (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	0.4547	0.4269	0.4176	0.3897	0.3897	0.3805	0.3805	0.3712	0.3712	0.3990	0.3990	0.4083 (22b)
Effective ac	0.6034	0.5911	0.5872	0.5759	0.5759	0.5724	0.5724	0.5689	0.5689	0.5796	0.5796	0.5834 (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			39.2600	0.1800	7.0668	75.6000	2968.0560 (28a)
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.2100	12.7602	7.4000	449.6462 (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)			151.1660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.4552		(33)
Party Wall			57.7220	0.0000	0.0000	7.4000	427.1428 (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) = 5270.6142 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1245 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.7642 (36)
Total fabric heat loss							(33) + (36) = 55.2194 (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	39.0077	38.2144	37.9611	37.2346	37.2346	37.0036	37.0036	36.7782	36.7782	37.4712	37.4712	37.7134 (38)
Heat transfer coeff	94.2271	93.4338	93.1805	92.4541	92.4541	92.2231	92.2231	91.9976	91.9976	92.6907	92.6907	92.9328 (39)
Average = Sum(39)m / 12 =												92.7088 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2000	1.1899	1.1867	1.1775	1.1775	1.1745	1.1745	1.1716	1.1716	1.1805	1.1805	1.1836 (40)
HLP (average)												1.1807 (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)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	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)
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			
North				2.5540	13.4684	0.7300	0.7200	0.7700	12.5293 (74)			
South				7.2440	56.5862	0.7300	0.7200	0.7700	149.3061 (78)			
Solar gains	161.8354	227.9985	304.3589	366.1422	379.7070	414.1373	386.6500	373.5677	341.5872	271.0295	191.6653	137.2036 (83)
Total gains	708.4493	769.9319	824.6690	853.2009	832.8840	837.1266	792.1836	787.6420	774.9837	737.8875	695.5339	668.9135 (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	15.5376	15.6695	15.7121	15.8355	15.8355	15.8752	15.8752	15.9141	15.9141	15.7951	15.7951	15.7540
alpha	2.0358	2.0446	2.0475	2.0557	2.0557	2.0583	2.0583	2.0609	2.0609	2.0530	2.0530	2.0503
util living area	0.8646	0.8406	0.7956	0.7268	0.6277	0.4712	0.3493	0.3414	0.5238	0.7018	0.8165	0.8733 (86)
MIT	18.6984	18.9231	19.3719	19.9136	20.4181	20.7869	20.9224	20.9283	20.7188	20.1923	19.4241	18.6842 (87)
Th 2	19.9200	19.9281	19.9306	19.9381	19.9381	19.9404	19.9404	19.9428	19.9428	19.9357	19.9357	19.9332 (88)
util rest of house	0.8495	0.8232	0.7727	0.6940	0.5768	0.3942	0.2485	0.2393	0.4498	0.6583	0.7929	0.8590 (89)
MIT 2	16.9448	17.2622	17.8923	18.6446	19.3195	19.7664	19.9006	19.9075	19.6969	19.0325	17.9799	16.9313 (90)
Living area fraction	17.3004	17.5989	18.1923	18.9019	19.5423	19.9733	20.1078	20.1145	19.9041	19.2676	18.2728	17.2867 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1504	17.4489	18.0423	18.7519	19.3923	19.8233	19.9578	19.9645	19.7541	19.1176	18.1228	17.1367 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	565.1817	593.8925	595.8781	555.2762	455.7910	322.2291	198.2421	190.2479	337.2978	456.8552	516.1574	540.5886 (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	1078.9353	1060.3742	963.7012	799.9039	581.7448	361.8164	208.2182	199.1247	391.3682	631.9313	864.1319	1053.5545 (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	382.2327	313.4757	273.6604	176.1319	93.7096	0.0000	0.0000	0.0000	0.0000	130.2566	250.5417	381.6467 (98)
Space heating												2001.6552 (98)
RHI space heating demand												2002 (98)

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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	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												4.6500		
Infiltration rate												0.4367 (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) =	0.3712 (21)		
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Wind factor	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)		
Adj infilt rate	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)		
	0.4732	0.4640	0.4547	0.4083	0.3990	0.3526	0.3526	0.3433	0.3712	0.3990	0.4176	0.4361 (22b)		
Effective ac	0.6120	0.6076	0.6034	0.5834	0.5796	0.5622	0.5622	0.5589	0.5689	0.5796	0.5872	0.5951 (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			39.2600	0.1800	7.0668	75.6000	2968.0560 (28a)					
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.2100	12.7602	7.4000	449.6462 (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)			151.1660				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	38.4552		(33)					
Party Wall			57.7220	0.0000	0.0000	7.4000	427.1428 (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) = 5270.6142 (34)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							67.1245 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.7642 (36)					
Total fabric heat loss							(33) + (36) = 55.2194 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	39.5643	39.2832	39.0077	37.7134	37.4712	36.3439	36.3439	36.1352	Sep 36.7782	Oct 37.4712	Nov 37.9611	Dec 38.4732 (38)
Heat transfer coeff	94.7838	94.5027	94.2271	92.9328	92.6907	91.5634	91.5634	91.3546	91.9976	92.6907	93.1805	93.6927 (39)
Average = Sum(39)m / 12 =												92.9317 (39)
HLP	Jan 1.2071	Feb 1.2035	Mar 1.2000	Apr 1.1836	May 1.1805	Jun 1.1661	Jul 1.1661	Aug 1.1635	Sep 1.1716	Oct 1.1805	Nov 1.1867	Dec 1.1932 (40)
HLP (average)												1.1835 (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												

FULL SAP CALCULATION PRINTOUT

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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	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
North					2.5540	10.6334	0.7300	0.7200	0.7700			9.8919 (74)
South					7.2440	46.7521	0.7300	0.7200	0.7700			123.3581 (78)

Solar gains	133.2501	220.9329	289.4714	342.4571	372.6001	366.0951	354.4654	331.8857	307.4530	240.4098	158.4244	114.8392 (83)
Total gains	679.8640	762.8663	809.7815	829.5159	825.7771	789.0844	759.9989	745.9600	740.8495	707.2678	662.2931	646.5491 (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	15.4463	15.4923	15.5376	15.7540	15.7951	15.9896	15.9896	16.0261	15.9141	15.7951	15.7121	15.6262
alpha	2.0298	2.0328	2.0358	2.0503	2.0530	2.0660	2.0660	2.0684	2.0609	2.0530	2.0475	2.0417
util living area	0.8888	0.8602	0.8235	0.7675	0.6868	0.5699	0.4518	0.4727	0.6201	0.7694	0.8578	0.8974 (86)
MIT	18.2917	18.6019	19.0585	19.6362	20.1745	20.6161	20.8324	20.8093	20.5072	19.8248	18.9702	18.2331 (87)
Th 2	19.9143	19.9172	19.9200	19.9332	19.9357	19.9472	19.9472	19.9493	19.9428	19.9357	19.9306	19.9254 (88)
util rest of house	0.8769	0.8456	0.8043	0.7402	0.6457	0.5062	0.3640	0.3871	0.5612	0.7374	0.8406	0.8863 (89)
MIT 2	16.3637	16.8021	17.4481	18.2621	18.9992	19.5777	19.8249	19.8039	19.4452	18.5369	17.3390	16.2845 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	16.7546	17.1670	17.7746	18.5407	19.2375	19.7882	20.0292	20.0077	19.6606	18.7981	17.6697	16.6796 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6046	17.0170	17.6246	18.3907	19.0875	19.6382	19.8792	19.8577	19.5106	18.6481	17.5197	16.5296 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8268	0.7936	0.7524	0.6925	0.6078	0.4854	0.3578	0.3790	0.5339	0.6902	0.7890	0.8376 (94)
Useful gains	562.0873	605.4020	609.2701	574.4761	501.9173	382.9979	271.9450	282.7127	395.5330	488.1529	522.5393	541.5359 (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	1166.2803	1145.0852	1048.2393	882.0010	684.7492	461.3167	300.2506	315.8792	497.7578	745.9798	970.9125	1155.1946 (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	449.5195	362.6672	326.5932	221.4180	136.0269	0.0000	0.0000	0.0000	0.0000	191.8232	322.8287	456.5620 (98)
Space heating												2467.4386 (98)
Space heating per m2												(98) / (4) = 31.4243 (99)

8c. Space cooling requirement

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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												2735.5196 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	449.5195	362.6672	326.5932	221.4180	136.0269	0.0000	0.0000	0.0000	0.0000	191.8232	322.8287	456.5620 (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)	498.3587	402.0700	362.0767	245.4744	150.8059	0.0000	0.0000	0.0000	0.0000	212.6643	357.9032	506.1663 (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	87.2767	87.0935	86.7406	85.9740	84.5232	76.4000	76.4000	76.4000	76.4000	85.3735	86.6966	76.4000 (216)
Fuel for water heating, kWh/month	117.2514	102.4633	106.6901	96.2882	95.2596	92.5669	88.6492	99.8298	100.4158	102.3601	107.3147	113.5226 (219)
Water heating fuel used												1222.6115 (219)
Annual totals kWh/year												
Space heating fuel - main system												2735.5196 (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												4405.5660 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2735.5196	3.4800	95.1961 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1222.6115	3.4800	42.5469 (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			316.7596 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	1.0771 (257)
SAP value		84.9749
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	2735.5196	0.2160	590.8722 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1222.6115	0.2160	264.0841 (264)
Space and water heating			854.9563 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.4349	0.5190	193.2937 (268)
Total kg/year			1087.1750 (272)
CO2 emissions per m2			13.8500 (273)
EI value			88.2058
EI rating			88 (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	$3.48 / 0.8306 = 4.190$, stars = 5
Water heating environmental impact	$0.216 / 0.8306 = 0.2601$, stars = 5

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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 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					4.6500
Infiltration rate					0.4367 (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) =	0.3712 (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	0.4547	0.4269	0.4176	0.3897	0.3897	0.3805	0.3805	0.3712	0.3712	0.3990	0.3990	0.4083 (22b)
Effective ac	0.6034	0.5911	0.5872	0.5759	0.5759	0.5724	0.5724	0.5689	0.5689	0.5796	0.5796	0.5834 (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			39.2600	0.1800	7.0668	75.6000	2968.0560 (28a)
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.2100	12.7602	7.4000	449.6462 (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)			151.1660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.4552		(33)
Party Wall			57.7220	0.0000	0.0000	7.4000	427.1428 (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) = 5270.6142 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1245 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							16.7642 (36)
Total fabric heat loss							(33) + (36) = 55.2194 (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	39.0077	38.2144	37.9611	37.2346	37.2346	37.0036	37.0036	36.7782	36.7782	37.4712	37.4712	37.7134 (38)
Heat transfer coeff	94.2271	93.4338	93.1805	92.4541	92.4541	92.2231	92.2231	91.9976	91.9976	92.6907	92.6907	92.9328 (39)
Average = Sum(39)m / 12 =												92.7088 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2000	1.1899	1.1867	1.1775	1.1775	1.1745	1.1745	1.1716	1.1716	1.1805	1.1805	1.1836 (40)
HLP (average)												1.1807 (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												

	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)
								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			
North				2.5540	13.4684	0.7300		0.7200	0.7700		12.5293 (74)	
South				7.2440	56.5862	0.7300		0.7200	0.7700		149.3061 (78)	
Solar gains	161.8354	227.9985	304.3589	366.1422	379.7070	414.1373	386.6500	373.5677	341.5872	271.0295	191.6653	137.2036 (83)
Total gains	708.4493	769.9319	824.6690	853.2009	832.8840	837.1266	792.1836	787.6420	774.9837	737.8875	695.5339	668.9135 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n11,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	15.5376	15.6695	15.7121	15.8355	15.8355	15.8752	15.8752	15.9141	15.9141	15.7951	15.7951	15.7540
alpha	2.0358	2.0446	2.0475	2.0557	2.0557	2.0583	2.0583	2.0609	2.0609	2.0530	2.0530	2.0503
util living area	0.8646	0.8406	0.7956	0.7268	0.6277	0.4712	0.3493	0.3414	0.5238	0.7018	0.8165	0.8733 (86)
MIT	18.6984	18.9231	19.3719	19.9136	20.4181	20.7869	20.9224	20.9283	20.7188	20.1923	19.4241	18.6842 (87)
Th 2	19.9200	19.9281	19.9306	19.9381	19.9381	19.9404	19.9404	19.9428	19.9428	19.9357	19.9357	19.9332 (88)
util rest of house	0.8495	0.8232	0.7727	0.6940	0.5768	0.3942	0.2485	0.2393	0.4498	0.6583	0.7929	0.8590 (89)
MIT 2	16.9448	17.2622	17.8923	18.6446	19.3195	19.7664	19.9006	19.9075	19.6969	19.0325	17.9799	16.9313 (90)
Living area fraction										fLA = Living area / (4) =		0.2028 (91)
MIT	17.3004	17.5989	18.1923	18.9019	19.5423	19.9733	20.1078	20.1145	19.9041	19.2676	18.2728	17.2867 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.1504	17.4489	18.0423	18.7519	19.3923	19.8233	19.9578	19.9645	19.7541	19.1176	18.1228	17.1367 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.7978	0.7714	0.7226	0.6508	0.5472	0.3849	0.2502	0.2415	0.4352	0.6191	0.7421	0.8082 (94)
Useful gains	565.1817	593.8925	595.8781	555.2762	455.7910	322.2291	198.2421	190.2479	337.2978	456.8552	516.1574	540.5886 (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												
	1078.9353	1060.3742	963.7012	799.9039	581.7448	361.8164	208.2182	199.1247	391.3682	631.9313	864.1319	1053.5545 (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												
	382.2327	313.4757	273.6604	176.1319	93.7096	0.0000	0.0000	0.0000	0.0000	130.2566	250.5417	381.6467 (98)
Space heating												2001.6552 (98)
Space heating per m2												25.4923 (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 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													2219.1300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	382.2327	313.4757	273.6604	176.1319	93.7096	0.0000	0.0000	0.0000	0.0000	130.2566	250.5417	381.6467	(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)	423.7613	347.5340	303.3929	195.2682	103.8909	0.0000	0.0000	0.0000	0.0000	144.4087	277.7624	423.1116	(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	86.8857	86.7286	86.2624	85.2752	83.2506	76.4000	76.4000	76.4000	76.4000	84.1006	85.9938	76.4000	(216)
Fuel for water heating, kWh/month	117.7790	102.8943	107.2816	97.0773	96.7157	92.5669	88.6492	99.8298	100.4158	103.9095	108.1916	114.0750	(219)
Water heating fuel used												1229.3857	(219)
Annual totals kWh/year													
Space heating fuel - main system												2219.1300	(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												3895.9505	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2219.1300	10.2300	227.0170 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1229.3857	10.2300	125.7662 (247)
Pumps and fans for heating	75.0000	36.7200	27.5400 (249)
Energy for lighting	372.4349	36.7200	136.7581 (250)
Additional standing charges			103.0000 (251)
Total energy cost			620.0812 (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	2219.1300	0.2160	479.3321 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1229.3857	0.2160	265.5473 (264)
Space and water heating			744.8794 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.4349	0.5190	193.2937 (268)
Total kg/year			977.0981 (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	2219.1300	1.2200	2707.3386 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1229.3857	1.2200	1499.8505 (264)
Space and water heating			4207.1891 (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			5580.8143 (272)
Primary energy kWh/m2/year			71.0751 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 88

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	+ 10.8	-£ 715	-1010 kg (103.4%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.9	-£ 61	-142 kg (14.5%)
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Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar photovoltaic panels	£715	12.87 kg/m²	A 96	A 98
Total Savings	£715	12.87 kg/m²		
Potential energy efficiency rating:			A 96	
Potential environmental impact rating:				A 98

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
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	£164	£164	£0
Mains gas	£456	£456	£0
Space heating	£358	£358	£0
Water heating	£126	£126	£0
Lighting	£137	£137	£0
Generated (PV)	-£0	-£715	£715
Total cost of fuels	£620	-£95	£715
Total cost of uses	£621	-£94	£715
Delivered energy	50 kWh/m²	25 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.0 tonnes	1.0 tonnes
CO2 emissions per m²	12 kg/m²	0 kg/m²	13 kg/m²
Primary energy	71 kWh/m²	-5 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	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					4.6500
Infiltration rate					0.4367 (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) =	0.3712 (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	0.4732	0.4640	0.4547	0.4083	0.3990	0.3526	0.3526	0.3433	0.3712	0.3990	0.4176	0.4361 (22b)
Effective ac	0.6120	0.6076	0.6034	0.5834	0.5796	0.5622	0.5622	0.5589	0.5689	0.5796	0.5872	0.5951 (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			39.2600	0.1800	7.0668	75.6000	2968.0560 (28a)
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.2100	12.7602	7.4000	449.6462 (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)			151.1660				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.4552		(33)
Party Wall			57.7220	0.0000	0.0000	7.4000	427.1428 (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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss
(28)...(30) + (32) + (32a)...(32e) = 5270.6142 (34)
67.1245 (35)
16.7642 (36)
(33) + (36) = 55.2194 (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	39.5643	39.2832	39.0077	37.7134	37.4712	36.3439	36.3439	36.1352	36.7782	37.4712	37.9611	38.4732 (38)
Heat transfer coeff	94.7838	94.5027	94.2271	92.9328	92.6907	91.5634	91.5634	91.3546	91.9976	92.6907	93.1805	93.6927 (39)
Average = Sum(39)m / 12 =												92.9317 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2071	1.2035	1.2000	1.1836	1.1805	1.1661	1.1661	1.1635	1.1716	1.1805	1.1867	1.1932 (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

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)
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)
												1018.4772 (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	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		
North					2.5540	10.6334	0.7300	0.7200	0.7700	9.8919 (74)		
South					7.2440	46.7521	0.7300	0.7200	0.7700	123.3581 (78)		

Solar gains	133.2501	220.9329	289.4714	342.4571	372.6001	366.0951	354.4654	331.8857	307.4530	240.4098	158.4244	114.8392 (83)
Total gains	679.8640	762.8663	809.7815	829.5159	825.7771	789.0844	759.9989	745.9600	740.8495	707.2678	662.2931	646.5491 (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	15.4463	15.4923	15.5376	15.7540	15.7951	15.9896	15.9896	16.0261	15.9141	15.7951	15.7121	15.6262
alpha	2.0298	2.0328	2.0358	2.0503	2.0530	2.0660	2.0660	2.0684	2.0609	2.0530	2.0475	2.0417
util living area	0.8888	0.8602	0.8235	0.7675	0.6868	0.5699	0.4518	0.4727	0.6201	0.7694	0.8578	0.8974 (86)
MIT	18.2917	18.6019	19.0585	19.6362	20.1745	20.6161	20.8324	20.8093	20.5072	19.8248	18.9702	18.2331 (87)
Th 2	19.9143	19.9172	19.9200	19.9332	19.9357	19.9472	19.9472	19.9493	19.9428	19.9357	19.9306	19.9254 (88)
util rest of house	0.8769	0.8456	0.8043	0.7402	0.6457	0.5062	0.3640	0.3871	0.5612	0.7374	0.8406	0.8863 (89)
MIT 2	16.3637	16.8021	17.4481	18.2621	18.9992	19.5777	19.8249	19.8039	19.4452	18.5369	17.3390	16.2845 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	16.7546	17.1670	17.7746	18.5407	19.2375	19.7882	20.0292	20.0077	19.6606	18.7981	17.6697	16.6796 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.6046	17.0170	17.6246	18.3907	19.0875	19.6382	19.8792	19.8577	19.5106	18.6481	17.5197	16.5296 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8268	0.7936	0.7524	0.6925	0.6078	0.4854	0.3578	0.3790	0.5339	0.6902	0.7890	0.8376 (94)
Useful gains	562.0873	605.4020	609.2701	574.4761	501.9173	382.9979	271.9450	282.7127	395.5330	488.1529	522.5393	541.5359 (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	1166.2803	1145.0852	1048.2393	882.0010	684.7492	461.3167	300.2506	315.8792	497.7578	745.9798	970.9125	1155.1946 (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	449.5195	362.6672	326.5932	221.4180	136.0269	0.0000	0.0000	0.0000	0.0000	191.8232	322.8287	456.5620 (98)
Space heating												2467.4386 (98)
Space heating per m2												(98) / (4) = 31.4243 (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													2735.5196 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	449.5195	362.6672	326.5932	221.4180	136.0269	0.0000	0.0000	0.0000	0.0000	191.8232	322.8287	456.5620	(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)	498.3587	402.0700	362.0767	245.4744	150.8059	0.0000	0.0000	0.0000	0.0000	212.6643	357.9032	506.1663	(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	87.2767	87.0935	86.7406	85.9740	84.5232	76.4000	76.4000	76.4000	76.4000	85.3735	86.6966	87.3827	(216)
Fuel for water heating, kWh/month	117.2514	102.4633	106.6901	96.2882	95.2596	92.5669	88.6492	99.8298	100.4158	102.3601	107.3147	113.5226	(219)
Water heating fuel used												1222.6115	(219)
Annual totals kWh/year													
Space heating fuel - main system												2735.5196	(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												2678.3266	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2735.5196	3.4800	95.1961 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1222.6115	3.4800	42.5469 (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			88.9368 (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] =	0.3024 (257)
SAP value		95.7814
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	2735.5196	0.2160	590.8722 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1222.6115	0.2160	264.0841 (264)
Space and water heating			854.9563 (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			190.7378 (272)
CO2 emissions per m2			2.4300 (273)
EI value			97.9308
EI rating			98 (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										4.6500				
Infiltration rate										0.4367 (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) = 0.3712 (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)		
	0.4547	0.4269	0.4176	0.3897	0.3897	0.3805	0.3805	0.3712	0.3712	0.3990	0.3990	0.4083 (22b)		
Effective ac	0.6034	0.5911	0.5872	0.5759	0.5759	0.5724	0.5724	0.5689	0.5689	0.5796	0.5796	0.5834 (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			39.2600	0.1800	7.0668	75.6000	2968.0560	(28a)				
Wl - Brick (Timber Frame)	72.6500	11.8870	60.7630	0.2100	12.7602	7.4000	449.6462	(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)			151.1660					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.4552			(33)				
Party Wall			57.7220	0.0000	0.0000	7.4000	427.1428	(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) = 5270.6142 (34)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								67.1245 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								16.7642 (36)				
Total fabric heat loss							(33) + (36) =	55.2194 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	39.0077	38.2144	37.9611	37.2346	37.2346	37.0036	37.0036	36.7782	36.7782	37.4712	37.4712	37.7134 (38)
Heat transfer coeff	94.2271	93.4338	93.1805	92.4541	92.4541	92.2231	92.2231	91.9976	91.9976	92.6907	92.6907	92.9328 (39)
Average = Sum(39)m / 12 =												92.7088 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2000	1.1899	1.1867	1.1775	1.1775	1.1745	1.1745	1.1716	1.1716	1.1805	1.1805	1.1836 (40)
HLP (average)												1.1807 (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												

	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								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
	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 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													2219.1300 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	382.2327	313.4757	273.6604	176.1319	93.7096	0.0000	0.0000	0.0000	0.0000	130.2566	250.5417	381.6467	(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)	423.7613	347.5340	303.3929	195.2682	103.8909	0.0000	0.0000	0.0000	0.0000	144.4087	277.7624	423.1116	(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	86.8857	86.7286	86.2624	85.2752	83.2506	76.4000	76.4000	76.4000	76.4000	84.1006	85.9938	76.4000	(216)
Fuel for water heating, kWh/month	117.7790	102.8943	107.2816	97.0773	96.7157	92.5669	88.6492	99.8298	100.4158	103.9095	108.1916	114.0750	(219)
Water heating fuel used												1229.3857	(219)
Annual totals kWh/year													
Space heating fuel - main system												2219.1300	(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												1949.5046	(238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2219.1300	10.2300	227.0170	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1229.3857	10.2300	125.7662	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	372.4349	36.7200	136.7581	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-1946.4459	36.7200	-714.7349	(252)
Total energy cost			-94.6537	(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	2219.1300	0.2160	479.3321	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1229.3857	0.2160	265.5473	(264)
Space and water heating			744.8794	(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			-33.1073	(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	2219.1300	1.2200	2707.3386	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1229.3857	1.2200	1499.8505	(264)
Space and water heating			4207.1891	(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			-394.7748	(272)
Primary energy kWh/m2/year			-5.0277	(273)

BASIC COMPLIANCE REPORT

Calculation Type: New Build (As Built)

Property Reference	006 - PRJ013014			Issued on Date	30/11/2023
Assessment Reference	006	Prop Type Ref	E		
Property	6 Rashleigh Drive, Netley Abbey, Southampton, SO31 5JY				
SAP Rating	85 B	DER	14.83	TER	17.77
Environmental	88 B	% DER<TER	16.57		
CO ₂ Emissions (t/year)	0.98	DFEE	42.80	TFEE	46.95
General Requirements Compliance	Pass	% DFEE<TFEE	8.84		
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)	17.77	kgCO ₂ /m ²	
Dwelling Carbon Dioxide Emission Rate (DER)	14.83	kgCO ₂ /m ²	Pass
	-2.94 (-16.5%)	kgCO ₂ /m ²	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	46.95	kWh/m ² /yr	
Dwelling Fabric Energy Efficiency (DFEE)	42.80	kWh/m ² /yr	
	-4.1 (-8.7%)	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	4.65 (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 North

2.55 m², No overhang

Windows facing South

7.24 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

4.65 (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