

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	020 - PRJ013014			Issued on Date	08/02/2024
Assessment Reference	020	Prop Type Ref	E		
Property	2 Deeble way, Netley Abbey, Southampton, SO31 5JP				
SAP Rating	85 B	DER	15.61	TER	18.87
Environmental	88 B	% DER<TER	17.29		
CO ₂ Emissions (t/year)	1.03	DFEE	46.63	TFEE	52.76
General Requirements Compliance	Pass	% DFEE<TFEE	11.62		
Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk			Assessor ID	U903-0001
Client					

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

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DWELLING AS BUILT

Semi-Detached 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) 18.87 kgCO₂/m²

Dwelling Carbon Dioxide Emission Rate (DER) 15.61 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.8 kWh/m²/yr

Dwelling Fabric Energy Efficiency (DFEE) 46.6 kWh/m²/yrOK

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: 4.51 (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 South East: 2.55 m², No overhang

Windows facing North West: 7.24 m², No overhang

Air change rate: 4.71 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					4.5100
Infiltration rate					0.4297 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3975 (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	0.5068	0.4968	0.4869	0.4372	0.4273	0.3776	0.3776	0.3676	0.3975	0.4273	0.4471	0.4670 (22b)
Effective ac	0.6284	0.6234	0.6185	0.5956	0.5913	0.5713	0.5713	0.5676	0.5790	0.5913	0.6000	0.6090 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.2100	16.1228	7.4000	568.1350 (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)			167.1810				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8183		(33)
Party Wall			41.7100	0.0000	0.0000	7.4000	308.6540 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8893 (36)
Total fabric heat loss							(33) + (36) = 56.7076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.6256	40.3033	39.9873	38.5033	38.2257	36.9331	36.9331	36.6938	37.4310	38.2257	38.7874	39.3746 (38)
Heat transfer coeff	97.3332	97.0109	96.6949	95.2109	94.9333	93.6407	93.6407	93.4014	94.1386	94.9333	95.4950	96.0822 (39)
Average = Sum(39)m / 12 =												95.2096 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2396	1.2355	1.2315	1.2126	1.2090	1.1926	1.1926	1.1895	1.1989	1.2090	1.2162	1.2237 (40)
HLP (average)												1.2126 (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)	
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													3381.2897 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	541.9374	448.0855	408.4499	276.6098	169.4371	0.0000	0.0000	0.0000	0.0000	256.8370	401.9314	546.6353	(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)	600.8175	496.7688	452.8269	306.6628	187.8460	0.0000	0.0000	0.0000	0.0000	284.7416	445.6002	606.0258	(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	87.6843	87.5729	87.2876	86.5970	85.2403	76.4000	76.4000	76.4000	76.4000	86.2451	87.2381	76.4000	(216)
Fuel for water heating, kWh/month	116.7063	101.9023	106.0216	95.5954	94.4582	92.5669	88.6492	99.8298	100.4158	101.3256	106.6485	113.0281	(219)
Water heating fuel used												1217.1476	(219)
Annual totals kWh/year													
Space heating fuel - main system												3381.2897	(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												5045.8722	(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	3381.2897	0.2160	730.3586 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1217.1476	0.2160	262.9039 (264)
Space and water heating			993.2625 (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			1225.4812 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.6100 (273)

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

DER		15.6100	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		34.1949	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		34.1949	ZC8

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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	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1531 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4031 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3729 (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	0.4754	0.4661	0.4568	0.4102	0.4009	0.3543	0.3543	0.3449	0.3729	0.4009	0.4195	0.4382	(22b)				
Effective ac	0.6130	0.6086	0.6043	0.5841	0.5803	0.5627	0.5627	0.5595	0.5695	0.5803	0.5880	0.5960	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			9.8000	1.3258	12.9792		(27)					
Flr - Ground			39.2630	0.1300	5.1042		(28a)					
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.1800	13.8195		(29a)					
Rf - Ins Joist	39.2630		39.2630	0.1300	5.1042		(30)					
Total net area of external elements Aum(A, m2)			167.1810				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0970		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7265 (36)					
Total fabric heat loss						(33) + (36) =	47.8235 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.6317	Feb 39.3479	Mar 39.0698	Apr 37.7635	May 37.5191	Jun 36.3813	Jul 36.3813	Aug 36.1706	Sep 36.8196	Oct 37.5191	Nov 38.0135	Dec 38.5304 (38)
Heat transfer coeff	87.4552	87.1715	86.8934	85.5870	85.3426	84.2049	84.2049	83.9942	84.6431	85.3426	85.8371	86.3540 (39)
Average = Sum(39)m / 12 =												85.5859 (39)
HLP	Jan 1.1138	Feb 1.1102	Mar 1.1066	Apr 1.0900	May 1.0869	Jun 1.0724	Jul 1.0724	Aug 1.0697	Sep 1.0780	Oct 1.0869	Nov 1.0932	Dec 1.0998 (40)
HLP (average)												1.0900 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4342 (42)
Average daily hot water use (litres/day)												92.0118 (43)
Daily hot water use	Jan 101.2129	Feb 97.5325	Mar 93.8520	Apr 90.1715	May 86.4911	Jun 82.8106	Jul 82.8106	Aug 86.4911	Sep 90.1715	Oct 93.8520	Nov 97.5325	Dec 101.2129 (44)
Energy conte	150.0959	131.2748	135.4638	118.1007	113.3204	97.7869	90.6139	103.9808	105.2227	122.6269	133.8568	145.3598 (45)
Energy content (annual)										Total = Sum(45)m =		1447.7033 (45)
Distribution loss (46)m = 0.15 x (45)m												
Water storage loss:	22.5144	19.6912	20.3196	17.7151	16.9981	14.6680	13.5921	15.5971	15.7834	18.3940	20.0785	21.8040 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage												

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	44.8917	47.8259	44.4681	44.0749	40.8381	42.1994	44.0749	44.4681	47.8259	48.0982	50.9589 (61)
Solar input	201.0548	176.1665	183.2898	162.5688	157.3953	138.6250	132.8133	148.0557	149.6908	170.4528	181.9550	196.3187 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	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)
	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
Southeast					2.5540	36.7938	0.6300	0.7000				0.7700	28.7189
Northwest					7.2440	11.2829	0.6300	0.7000				0.7700	24.9789
Solar gains	53.6978	99.7641	158.5398	233.3780	295.1194	307.8161	290.5956	242.2664	184.0987	116.2027	65.8285		44.9764
Total gains	437.9534	481.3438	525.8992	578.3406	617.4248	608.3678	577.5302	535.9329	489.6943	444.4053	419.8054		418.1607

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	62.3494	62.5523	62.7525	63.7103	63.8928	64.7561	64.7561	64.9185	64.4208	63.8928	63.5247	63.1445	
alpha	5.1566	5.1702	5.1835	5.2474	5.2595	5.3171	5.3171	5.3279	5.2947	5.2595	5.2350	5.2096	
util living area	0.9986	0.9974	0.9937	0.9787	0.9252	0.7866	0.6184	0.6807	0.9052	0.9867	0.9973	0.9989	(86)
MIT	19.7681	19.8875	20.1110	20.4321	20.7308	20.9268	20.9838	20.9738	20.8294	20.4566	20.0640	19.7530	(87)
Th 2	19.9896	19.9925	19.9954	20.0090	20.0116	20.0234	20.0234	20.0256	20.0189	20.0116	20.0064	20.0010	(88)
util rest of house	0.9981	0.9965	0.9913	0.9698	0.8924	0.7020	0.4929	0.5558	0.8506	0.9796	0.9961	0.9985	(89)
MIT 2	18.3407	18.5173	18.8453	19.3184	19.7310	19.9708	20.0170	20.0138	19.8689	19.3596	18.7856	18.3268	(90)
Living area fraction	18.6301	18.7951	19.1019	19.5442	19.9337	20.1646	20.2130	20.2084	20.0636	19.5821	19.0448	18.6160	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6301	18.7951	19.1019	19.5442	19.9337	20.1646	20.2130	20.2084	20.0636	19.5821	19.0448	18.6160	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	436.6921	478.8786	519.7287	557.6701	549.0624	435.3123	299.3820	311.3112	418.0111	433.4256	417.4836	417.2148	(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	1253.2448	1211.2593	1095.0237	911.0064	702.6843	468.5686	304.2326	319.8872	504.7814	766.5527	1025.3051	1244.8784	(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	607.5152	492.1598	428.0195	254.4021	114.2947	0.0000	0.0000	0.0000	0.0000	247.8466	437.6314	615.7817	(98)
Space heating												3197.6509	(98)
Space heating per m2												40.7240	(99)

8c. Space cooling requirement

Not applicable

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

FULL SAP CALCULATION PRINTOUT

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													3423.6091 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	607.5152	492.1598	428.0195	254.4021	114.2947	0.0000	0.0000	0.0000	0.0000	247.8466	437.6314	615.7817	(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)	650.4445	526.9377	458.2650	272.3791	122.3712	0.0000	0.0000	0.0000	0.0000	265.3603	468.5562	659.2952	(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 (217)m	87.6584	87.4990	87.1147	86.1741	84.2603	80.3000	80.3000	80.3000	80.3000	85.9926	87.1798	87.7324	(217)
Fuel for water heating, kWh/month	229.3615	201.3353	210.4005	188.6515	186.7965	172.6338	165.3964	184.3782	186.4144	198.2180	208.7124	223.7699	(219)
Water heating fuel used												2356.0684	(219)
Annual totals kWh/year													
Space heating fuel - main system												3423.6091	(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												6229.4472	(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	3423.6091	0.2160	739.4996 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2356.0684	0.2160	508.9108 (264)
Space and water heating			1248.4104 (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			1481.8408 (272)
Emissions per m2 for space and water heating			15.8993 (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) = (15.8993 * 1.00) + 2.4771 + 0.4957, rounded to 2 d.p.			18.8700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

Property Reference	020 - PRJ013014	Issued on Date	08/02/2024
Assessment Reference	020	Prop Type Ref	E
Property	2 Deeble way, Netley Abbey, Southampton, SO31 5JP		

SAP Rating	85 B	DER	15.61	TER	18.87
Environmental	88 B	% DER<TER	17.29		
CO ₂ Emissions (t/year)	1.03	DFEE	46.63	TFEE	52.76
General Requirements Compliance	Pass	% DFEE<TFEE	11.62		

Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk	Assessor ID	U903-0001
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Client	
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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	=		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													4.5100	
Infiltration rate													0.3786 (18)	
Number of sides sheltered													1 (19)	
Shelter factor											(20) = 1 - [0.075 x (19)] =		0.9250 (20)	
Infiltration rate adjusted to include shelter factor											(21) = (18) x (20) =		0.3502 (21)	
Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)	
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)	
Adj infiltr rate	0.4466	0.4378	0.4290	0.3853	0.3765	0.3327	0.3327	0.3240	0.3502	0.3765	0.3940	0.4115	(22b)	
Effective ac	0.5997	0.5958	0.5920	0.5742	0.5709	0.5554	0.5554	0.5525	0.5613	0.5709	0.5776	0.5847	(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)
Fir - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.2100	16.1228	7.4000	568.1350 (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)			167.1810				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8183		(33)
Party Wall			41.7100	0.0000	0.0000	7.4000	308.6540 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)
Heat capacity Cm = Sum (A x k)						(28)...(30) + (32) + (32a)...(32e) =	5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8893 (36)
Total fabric heat loss						(33) + (36) =	56.7076 (37)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

(38)m	Jan 38.7705	Feb 38.5202	Mar 38.2749	Apr 37.1225	May 36.9069	Jun 35.9032	Jul 35.9032	Aug 35.7174	Sep 36.2898	Oct 36.9069	Nov 37.3431	Dec 37.7991 (38)
Heat transfer coeff	95.4781	95.2278	94.9825	93.8301	93.6145	92.6108	92.6108	92.4250	92.9974	93.6145	94.0507	94.5067 (39)
Average = Sum(39)m / 12 =												93.8291 (39)
HLP	Jan 1.2160	Feb 1.2128	Mar 1.2097	Apr 1.1950	May 1.1922	Jun 1.1795	Jul 1.1795	Aug 1.1771	Sep 1.1844	Oct 1.1922	Nov 1.1978	Dec 1.2036 (40)
HLP (average)												1.1950 (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	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 121.7090	Feb 121.7090	Mar 121.7090	Apr 121.7090	May 121.7090	Jun 121.7090	Jul 121.7090	Aug 121.7090	Sep 121.7090	Oct 121.7090	Nov 121.7090	Dec 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			
Southeast				2.5540	36.7938	0.7300	0.7200	0.7700	34.2282 (77)			
Northwest				7.2440	11.2829	0.7300	0.7200	0.7700	29.7707 (81)			
Solar gains	63.9990	118.9025	188.9536	278.1485	351.7341	366.8665	346.3425	288.7420	219.4155	138.4946	78.4568	53.6045 (83)
Total gains	403.7901	457.2221	515.2979	584.9150	637.8979	633.8949	601.4328	547.7632	488.9478	427.7389	390.2960	383.0845 (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)												
tau	Jan 15.3346	Feb 15.3749	Mar 15.4147	Apr 15.6040	May 15.6399	Jun 15.8094	Jul 15.8094	Aug 15.8412	Sep 15.7437	Oct 15.6399	Nov 15.5674	Dec 15.4923
alpha	2.0223	2.0250	2.0276	2.0403	2.0427	2.0540	2.0540	2.0561	2.0496	2.0427	2.0378	2.0328
util living area	0.9528	0.9378	0.9102	0.8555	0.7686	0.6497	0.5363	0.5847	0.7580	0.8862	0.9387	0.9573 (86)
MIT	17.6650	17.9513	18.4893	19.2336	19.9407	20.4935	20.7622	20.7060	20.2426	19.3442	18.3857	17.6160 (87)
Th 2	19.9072	19.9098	19.9123	19.9240	19.9262	19.9365	19.9365	19.9384	19.9325	19.9262	19.9218	19.9171 (88)
util rest of house	0.9470	0.9301	0.8984	0.8351	0.7321	0.5861	0.4406	0.4920	0.7063	0.8659	0.9298	0.9520 (89)
MIT 2	16.8534	17.1380	17.6705	18.4053	19.0821	19.5929	19.8132	19.7771	19.3818	18.5262	17.5796	16.8112 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	17.0179	17.3029	17.8365	18.5733	19.2562	19.7755	20.0056	19.9654	19.5563	18.6921	17.7430	16.9743 (92)
Temperature adjustment												0.0000
adjusted MIT	17.0179	17.3029	17.8365	18.5733	19.2562	19.7755	20.0056	19.9654	19.5563	18.6921	17.7430	16.9743 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9253	0.9049	0.8689	0.8032	0.7054	0.5753	0.4475	0.4947	0.6845	0.8357	0.9051	0.9317	(94)
Useful gains	373.6283	413.7498	447.7481	469.7869	449.9451	364.6581	269.1112	270.9593	334.6673	357.4492	353.2423	356.9199	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Month fracti	1214.2825	1181.0994	1076.7706	907.6423	707.3705	479.3099	315.3962	329.5363	507.4209	757.5352	1000.9824	1207.2597	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	625.4467	515.6590	467.9927	315.2559	191.5245	0.0000	0.0000	0.0000	0.0000	297.6640	466.3729	632.6528	(98)
Space heating per m2												3512.5685	(98)
												(98) / (4) =	44.7347 (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													
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	870.5419	685.3202	702.4298	0.0000	0.0000	0.0000	0.0000	(100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.6574	0.7201	0.6864	0.0000	0.0000	0.0000	0.0000	(101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	572.2633	493.4659	482.1443	0.0000	0.0000	0.0000	0.0000	(102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	832.3700	792.6209	731.6578	0.0000	0.0000	0.0000	0.0000	(103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	187.2768	222.5713	185.6381	0.0000	0.0000	0.0000	0.0000	(104)
Cooled fraction												595.4861	(104)
Intermittency factor (Table 10b)												fC = cooled area / (4) =	1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	46.8192	55.6428	46.4095	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling per m2												148.8715	(107)
Energy for space heating												1.8960	(108)
Energy for space cooling												44.7347	(99)
Total												1.8960	(108)
Dwelling Fabric Energy Efficiency (DFEE)												46.6307	(109)
												46.6	(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	secondary	other	total	m3 per hour			
										heating	heating						
Number of chimneys										0	+	0	+	0	=	0 * 40 =	0.0000 (6a)
Number of open flues										0	+	0	+	0	=	0 * 20 =	0.0000 (6b)
Number of intermittent fans																3 * 10 =	30.0000 (7a)
Number of passive vents																0 * 10 =	0.0000 (7b)
Number of flueless gas fires																0 * 40 =	0.0000 (7c)
										Air changes per hour							
Infiltration due to chimneys, flues and fans										= (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000	/ (5) =	0.1531 (8)
Pressure test										Yes							
Measured/design AP50										5.0000							
Infiltration rate										0.4031 (18)							
Number of sides sheltered										1 (19)							
Shelter factor										(20) = 1 - [0.075 x (19)] =					0.9250 (20)		
Infiltration rate adjusted to include shelter factor										(21) = (18) x (20) =					0.3729 (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	0.4754	0.4661	0.4568	0.4102	0.4009	0.3543	0.3543	0.3449	0.3729	0.4009	0.4195	0.4382	(22b)				
Effective ac	0.6130	0.6086	0.6043	0.5841	0.5803	0.5627	0.5627	0.5595	0.5695	0.5803	0.5880	0.5960	(25)				

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0900	1.0000	2.0900		(26)					
TER Opening Type (Uw = 1.40)			9.8000	1.3258	12.9792		(27)					
Flr - Ground			39.2630	0.1300	5.1042		(28a)					
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.1800	13.8195		(29a)					
Rf - Ins Joist	39.2630		39.2630	0.1300	5.1042		(30)					
Total net area of external elements Aum(A, m2)			167.1810				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	39.0970		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.7265 (36)					
Total fabric heat loss						(33) + (36) =	47.8235 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 39.6317	Feb 39.3479	Mar 39.0698	Apr 37.7635	May 37.5191	Jun 36.3813	Jul 36.3813	Aug 36.1706	Sep 36.8196	Oct 37.5191	Nov 38.0135	Dec 38.5304 (38)
Heat transfer coeff	87.4552	87.1715	86.8934	85.5870	85.3426	84.2049	84.2049	83.9942	84.6431	85.3426	85.8371	86.3540 (39)
Average = Sum(39)m / 12 =												85.5859 (39)
HLP	Jan 1.1138	Feb 1.1102	Mar 1.1066	Apr 1.0900	May 1.0869	Jun 1.0724	Jul 1.0724	Aug 1.0697	Sep 1.0780	Oct 1.0869	Nov 1.0932	Dec 1.0998 (40)
HLP (average)												1.0900 (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	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			
Southeast				2.5540	36.7938	0.6300	0.7000	0.7700	28.7189 (77)			
Northwest				7.2440	11.2829	0.6300	0.7000	0.7700	24.9789 (81)			

Solar gains	53.6978	99.7641	158.5398	233.3780	295.1194	307.8161	290.5956	242.2664	184.0987	116.2027	65.8285	44.9764 (83)
Total gains	393.6211	438.2011	484.9796	540.2168	581.3372	574.8901	545.7351	501.3517	453.7169	405.5562	377.7952	374.5923 (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	62.3494	62.5523	62.7525	63.7103	63.8928	64.7561	64.7561	64.9185	64.4208	63.8928	63.5247	63.1445	
alpha	5.1566	5.1702	5.1835	5.2474	5.2595	5.3171	5.3171	5.3279	5.2947	5.2595	5.2350	5.2096	
util living area	0.9992	0.9983	0.9956	0.9840	0.9393	0.8133	0.6485	0.7160	0.9264	0.9911	0.9983	0.9994	(86)
MIT	19.7151	19.8362	20.0631	20.3905	20.7004	20.9134	20.9798	20.9668	20.8016	20.4124	20.0138	19.7007	(87)
Th 2	19.9896	19.9925	19.9954	20.0090	20.0116	20.0234	20.0234	20.0256	20.0189	20.0116	20.0064	20.0010	(88)
util rest of house	0.9989	0.9977	0.9939	0.9771	0.9110	0.7317	0.5197	0.5899	0.8797	0.9862	0.9976	0.9991	(89)
MIT 2	18.8109	18.9342	19.1628	19.4975	19.7941	19.9797	20.0178	20.0150	19.8954	19.5236	19.1230	18.8057	(90)
Living area fraction									fLA = Living area / (4) =			0.2028	(91)
MIT	18.9942	19.1171	19.3453	19.6786	19.9779	20.1690	20.2129	20.2080	20.0791	19.7038	19.3036	18.9872	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9942	19.1171	19.3453	19.6786	19.9779	20.1690	20.2129	20.2080	20.0791	19.7038	19.3036	18.9872	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9984	0.9970	0.9924	0.9741	0.9099	0.7454	0.5461	0.6156	0.8833	0.9841	0.9969	0.9988	(94)
Ext temp.	393.0091	436.8873	481.3136	526.2171	528.9366	428.5198	298.0442	308.6343	400.7633	399.0996	376.6334	374.1473	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1285.0857	1239.3219	1116.1753	922.5075	706.4543	468.9398	304.2196	319.8471	506.0929	776.9451	1047.5223	1276.9307	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	663.7051	539.2360	472.3371	285.3290	132.0731	0.0000	0.0000	0.0000	0.0000	281.1171	483.0400	671.6708	(98)
Space heating per m2										(98) / (4) =		3528.5082	(98)
												44.9377	(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	791.5259	623.1161	638.3558	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8261	0.8991	0.8659	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	653.8972	560.2645	552.7590	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	763.4640	727.5854	677.4959	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	78.8882	124.4868	92.8043	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												296.1792	(104)
Cooled fraction									fC = cooled area / (4) =			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	19.7220	31.1217	23.2011	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling											74.0448 (107)
Space cooling per m2											0.9430 (108)
Energy for space heating											44.9377 (99)
Energy for space cooling											0.9430 (108)
Total											45.8807 (109)
Target Fabric Energy Efficiency (TFEE)											52.8 (109)

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Calculation Type: New Build (As Built)

Property Reference	020 - PRJ013014	Issued on Date	08/02/2024
Assessment Reference	020	Prop Type Ref	E
Property	2 Deeble way, Netley Abbey, Southampton, SO31 5JP		

SAP Rating	85 B	DER	15.61	TER	18.87
Environmental	88 B	% DER<TER	17.29		
CO ₂ Emissions (t/year)	1.03	DFEE	46.63	TFEE	52.76
General Requirements Compliance	Pass	% DFEE<TFEE	11.62		

Assessor Details	Mr. Christopher Nicholls, Briary Energy Limited, Tel: 0203 397 1373, chris@briaryenergy.co.uk	Assessor ID	U903-0001
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Client	
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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	=	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							4.5100					
Infiltration rate							0.4297 (18)					
Number of sides sheltered							1 (19)					
Shelter factor						(20) = 1 - [0.075 x (19)] =	0.9250 (20)					
Infiltration rate adjusted to include shelter factor						(21) = (18) x (20) =	0.3975 (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 infiltr rate	0.4869	0.4571	0.4471	0.4173	0.4173	0.4074	0.4074	0.3975	0.3975	0.4273	0.4273	0.4372 (22b)
Effective ac	0.6185	0.6045	0.6000	0.5871	0.5871	0.5830	0.5830	0.5790	0.5790	0.5913	0.5913	0.5956 (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)
Fir - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.2100	16.1228	7.4000	568.1350 (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)			167.1810				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8183		(33)
Party Wall			41.7100	0.0000	0.0000	7.4000	308.6540 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8893 (36)
Total fabric heat loss							(33) + (36) = 56.7076 (37)

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

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(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat transfer coeff	39.9873	39.0778	38.7874	37.9544	37.9544	37.6895	37.6895	37.4310	37.4310	38.2257	38.2257	38.5033	(38)
Average = Sum(39)m / 12 =	96.6949	95.7854	95.4950	94.6620	94.6620	94.3971	94.3971	94.1386	94.1386	94.9333	94.9333	95.2109	(39)
												94.9540	(39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP (average)	1.2315	1.2199	1.2162	1.2056	1.2056	1.2022	1.2022	1.1989	1.1989	1.2090	1.2090	1.2126	(40)
Days in month												1.2093	(40)
	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)	
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														
	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)	
												Total per year (kWh/year) = Sum (64)m =	1453.7285	(64)
RHI water heating demand												1454	(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	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		
Southeast				2.5540	45.0642			0.7300	0.7200		0.7700	41.9219	
Northwest				7.2440	14.6130			0.7300	0.7200		0.7700	(77)	
													38.5574
													(81)
Solar gains	80.4793	128.0337	208.6875	311.4907	372.0258	428.3579	390.9133	339.2685	256.1250	163.4515	98.5093	66.1538	
Total gains	627.0932	669.9671	728.9976	798.5494	825.2028	851.3472	796.4468	753.3428	689.5215	630.3095	602.3780	597.8637	
													(83)
													(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	15.1417	15.2854	15.3319	15.4668	15.4668	15.5102	15.5102	15.5528	15.5528	15.4227	15.4227	15.3777	
alpha	2.0094	2.0190	2.0221	2.0311	2.0311	2.0340	2.0340	2.0369	2.0369	2.0282	2.0282	2.0252	
util living area	0.8889	0.8717	0.8295	0.7513	0.6366	0.4718	0.3537	0.3603	0.5713	0.7551	0.8521	0.8948 (86)	
MIT	18.4752	18.6793	19.1659	19.8041	20.3838	20.7788	20.9173	20.9173	20.6561	20.0323	19.2169	18.4814 (87)	
Th 2	19.8949	19.9041	19.9071	19.9155	19.9155	19.9182	19.9182	19.9209	19.9209	19.9128	19.9128	19.9100 (88)	
util rest of house	0.8757	0.8566	0.8087	0.7193	0.5850	0.3933	0.2499	0.2518	0.4945	0.7144	0.8314	0.8821 (89)	
MIT 2	16.6254	16.9161	17.6025	18.4895	19.2627	19.7393	19.8765	19.8806	19.6175	18.8194	17.6888	16.6404 (90)	
Living area fraction									fLA = Living area / (4) =			0.2028 (91)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF HEAT DEMAND 09 Jan 2014

MIT	17.0004	17.2736	17.9195	18.7560	19.4900	19.9501	20.0875	20.0908	19.8280	19.0653	17.9986	17.0136 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8504	17.1236	17.7695	18.6060	19.3400	19.8001	19.9375	19.9408	19.6780	18.9153	17.8486	16.8636 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8249	0.8047	0.7563	0.6729	0.5539	0.3840	0.2519	0.2539	0.4750	0.6685	0.7792	0.8325 (94)	
Useful gains	517.3030	539.0902	551.3301	537.3135	457.0642	326.9397	200.5899	191.2789	327.4997	421.3893	469.3445	497.7077 (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													
1078.1885	1055.9002	961.5843	805.1947	590.6888	368.1546	211.2122	201.5287	393.3150	628.0099	859.0119	1053.3792 (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													
417.2988	347.2963	305.2291	192.8745	99.4167	0.0000	0.0000	0.0000	0.0000	153.7257	280.5605	413.4197 (98)		
Space heating												2209.8213 (98)	
RHI space heating demand												2210 (98)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 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					4.5100
Infiltration rate					0.4297 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3975 (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	0.5068	0.4968	0.4869	0.4372	0.4273	0.3776	0.3776	0.3676	0.3975	0.4273	0.4471	0.4670 (22b)
Effective ac	0.6284	0.6234	0.6185	0.5956	0.5913	0.5713	0.5713	0.5676	0.5790	0.5913	0.6000	0.6090 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.2100	16.1228	7.4000	568.1350 (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)			167.1810				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8183		(33)
Party Wall			41.7100	0.0000	0.0000	7.4000	308.6540 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8893 (36)
Total fabric heat loss							(33) + (36) = 56.7076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.6256	40.3033	39.9873	38.5033	38.2257	36.9331	36.9331	36.6938	37.4310	38.2257	38.7874	39.3746 (38)
Heat transfer coeff	97.3332	97.0109	96.6949	95.2109	94.9333	93.6407	93.6407	93.4014	94.1386	94.9333	95.4950	96.0822 (39)
Average = Sum(39)m / 12 =												95.2096 (39)
HLP	1.2396	1.2355	1.2315	1.2126	1.2090	1.1926	1.1926	1.1895	1.1989	1.2090	1.2162	1.2237 (40)
HLP (average)												1.2126 (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												

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)
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	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)
WWHRS	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)
Total of WWHRS savings	-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)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	-435.2513
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)
Heat gains from water heating, kWh/month								Total per year (kWh/year) =	Sum (64)m =			1018.4772 (64)
	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 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			
				2,5540	36.7938	0.7300	0.7200	0.7700	34.2282 (77)			
				7,2440	11.2829	0.7300	0.7200	0.7700	29.7707 (81)			
Solar gains	63.9990	118.9025	188.9536	278.1485	351.7341	366.8665	346.3425	288.7420	219.4155	138.4946	78.4568	53.6045 (83)
Total gains	610.6129	660.8359	709.2637	765.2072	804.9112	789.8558	751.8761	702.8163	652.8121	605.3526	582.3255	585.3144 (84)

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	15.0424	15.0924	15.1417	15.3777	15.4227	15.6355	15.6355	15.6756	15.5528	15.4227	15.3319	15.2382
alpha	2.0028	2.0062	2.0094	2.0252	2.0282	2.0424	2.0424	2.0450	2.0369	2.0282	2.0221	2.0159
util living area	0.9072	0.8889	0.8558	0.7935	0.7002	0.5755	0.4616	0.4995	0.6690	0.8143	0.8843	0.9135 (86)
MIT	18.0760	18.3361	18.8227	19.4957	20.1172	20.5969	20.8192	20.7808	20.4090	19.6331	18.7606	18.0339 (87)
Th 2	19.8885	19.8917	19.8949	19.9100	19.9128	19.9259	19.9259	19.9284	19.9209	19.9128	19.9071	19.9011 (88)
util rest of house	0.8968	0.8764	0.8388	0.7675	0.6590	0.5106	0.3712	0.4101	0.6105	0.7857	0.8693	0.9037 (89)
MIT 2	16.0531	16.4232	17.1143	18.0631	18.9126	19.5399	19.7950	19.7610	19.3183	18.2734	17.0400	15.9967 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	16.4632	16.8110	17.4607	18.3536	19.1569	19.7542	20.0027	19.9678	19.5395	18.5491	17.3889	16.4098 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.3132	16.6610	17.3107	18.2036	19.0069	19.6042	19.8527	19.8178	19.3895	18.3991	17.2389	16.2598 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8484	0.8255	0.7859	0.7170	0.6189	0.4889	0.3644	0.3999	0.5768	0.7344	0.8184	0.8568 (94)
Useful gains	518.0398	545.5318	557.4135	548.6776	498.1423	386.1407	274.0067	281.0884	376.5669	444.5959	476.5555	501.5200 (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	1169.2842	1140.9455	1045.3363	885.8011	693.6632	468.5967	304.5806	319.2276	497.9445	740.3897	968.2105	1158.7289 (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	484.5258	400.1180	363.0145	242.7289	145.4676	0.0000	0.0000	0.0000	0.0000	220.0706	353.9916	488.9635 (98)
Space heating												2698.8805 (98)
Space heating per m2												34.3719 (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 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													2992.1069 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	484.5258	400.1180	363.0145	242.7289	145.4676	0.0000	0.0000	0.0000	0.0000	220.0706	353.9916	488.9635	(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)	537.1683	443.5898	402.4551	269.1008	161.2722	0.0000	0.0000	0.0000	0.0000	243.9807	392.4519	542.0881	(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	87.4457	87.3236	87.0074	86.2385	84.7460	76.4000	76.4000	76.4000	76.4000	85.7953	86.9319	76.4000	(216)
Fuel for water heating, kWh/month	117.0247	102.1932	106.3630	95.9929	95.0091	92.5669	88.6492	99.8298	100.4158	101.8569	107.0241	113.3272	(219)
Water heating fuel used												1220.2527	(219)
Annual totals kWh/year													
Space heating fuel - main system												2992.1069	(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												4659.7946	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2992.1069	3.4800	104.1253 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1220.2527	3.4800	42.4648 (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			325.6068 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] = 1.1071 (257)
SAP value	84.5553
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	2992.1069	0.2160	646.2951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1220.2527	0.2160	263.5746 (264)
Space and water heating			909.8697 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.4349	0.5190	193.2937 (268)
Total kg/year			1142.0884 (272)
CO2 emissions per m2			14.5500 (273)
EI value			87.6101
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	$3.48 / 0.8322 = 4.182$, stars = 5
Water heating environmental impact	$0.216 / 0.8322 = 0.2596$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main 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					4.5100
Infiltration rate					0.4297 (18)
Number of sides sheltered					1 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		0.9250 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3975 (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	0.4869	0.4571	0.4471	0.4173	0.4173	0.4074	0.4074	0.3975	0.3975	0.4273	0.4273	0.4372 (22b)
Effective ac	0.6185	0.6045	0.6000	0.5871	0.5871	0.5830	0.5830	0.5790	0.5790	0.5913	0.5913	0.5956 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.2100	16.1228	7.4000	568.1350 (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)			167.1810				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8183		(33)
Party Wall			41.7100	0.0000	0.0000	7.4000	308.6540 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 14.8893 (36)
Total fabric heat loss (33) + (36) = 56.7076 (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	39.9873	39.0778	38.7874	37.9544	37.9544	37.6895	37.6895	37.4310	37.4310	38.2257	38.2257	38.5033 (38)
Heat transfer coeff	96.6949	95.7854	95.4950	94.6620	94.6620	94.3971	94.3971	94.1386	94.1386	94.9333	94.9333	95.2109 (39)
Average = Sum(39)m / 12 =												94.9540 (39)
HLP	Jan 1.2315	Feb 1.2199	Mar 1.2162	Apr 1.2056	May 1.2056	Jun 1.2022	Jul 1.2022	Aug 1.1989	Sep 1.1989	Oct 1.2090	Nov 1.2090	Dec 1.2126 (40)
HLP (average)												1.2093 (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												

[illegible]

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			
Southeast				2.5540	45.0642	0.7300		0.7200	0.7700		41.9219 (77)	
Northwest				7.2440	14.6130	0.7300		0.7200	0.7700		68.5574 (81)	
Solar gains	80.4793	128.0337	208.6875	311.4907	372.0258	428.3579	390.9133	339.2685	256.1250	163.4515	98.5093	66.1538 (83)
Total gains	627.0932	669.9671	728.9976	798.5494	825.2028	851.3472	796.4468	753.3428	689.5215	630.3095	602.3780	597.8637 (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	15.1417	15.2854	15.3319	15.4668	15.4668	15.5102	15.5102	15.5528	15.5528	15.4227	15.4227	15.3777
alpha	2.0094	2.0190	2.0221	2.0311	2.0311	2.0340	2.0340	2.0369	2.0369	2.0282	2.0282	2.0252
util living area	0.8889	0.8717	0.8295	0.7513	0.6366	0.4718	0.3537	0.3603	0.5713	0.7551	0.8521	0.8948 (86)
MIT	18.4752	18.6793	19.1659	19.8041	20.3838	20.7788	20.9173	20.9173	20.6561	20.0323	19.2169	18.4814 (87)
Th 2	19.8949	19.9041	19.9071	19.9155	19.9155	19.9182	19.9182	19.9209	19.9209	19.9128	19.9128	19.9100 (88)
util rest of house	0.8757	0.8566	0.8087	0.7193	0.5850	0.3933	0.2499	0.2518	0.4945	0.7144	0.8314	0.8821 (89)
MIT 2	16.6254	16.9161	17.6025	18.4895	19.2627	19.7393	19.8765	19.8806	19.6175	18.8194	17.6888	16.6404 (90)
Living area fraction										fLA = Living area / (4) =		0.2028 (91)
MIT	17.0004	17.2736	17.9195	18.7560	19.4900	19.9501	20.0875	20.0908	19.8280	19.0653	17.9986	17.0136 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8504	17.1236	17.7695	18.6060	19.3400	19.8001	19.9375	19.9408	19.6780	18.9153	17.8486	16.8636 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8249	0.8047	0.7563	0.6729	0.5539	0.3840	0.2519	0.2539	0.4750	0.6685	0.7792	0.8325 (94)
Useful gains	517.3030	539.0902	551.3301	537.3135	457.0642	326.9397	200.5899	191.2789	327.4997	421.3893	469.3445	497.7077 (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												
	1078.1885	1055.9002	961.5843	805.1947	590.6888	368.1546	211.2122	201.5287	393.3150	628.0099	859.0119	1053.3792 (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												
	417.2988	347.2963	305.2291	192.8745	99.4167	0.0000	0.0000	0.0000	0.0000	153.7257	280.5605	413.4197 (98)
Space heating												2209.8213 (98)
Space heating per m2												28.1434 (99)
										(98) / (4) =		28.1434 (99)

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													2449.9127 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	417.2988	347.2963	305.2291	192.8745	99.4167	0.0000	0.0000	0.0000	0.0000	153.7257	280.5605	413.4197	(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)	462.6372	385.0292	338.3915	213.8298	110.2181	0.0000	0.0000	0.0000	0.0000	170.4276	311.0427	458.3367	(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	87.1016	86.9880	86.5623	85.5589	83.4546	76.4000	76.4000	76.4000	76.4000	84.6578	86.3173	76.4000	(216)
Fuel for water heating, kWh/month	117.4870	102.5875	106.9099	96.7554	96.4794	92.5669	88.6492	99.8298	100.4158	103.2255	107.7863	113.8210	(219)
Water heating fuel used												1226.5135	(219)
Annual totals kWh/year													
Space heating fuel - main system												2449.9127	(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												4123.8612	(238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2449.9127	7.6100	186.4384 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1226.5135	7.6100	93.3377 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	372.4349	31.0800	115.7528 (250)
Additional standing charges			105.0000 (251)
Total energy cost			523.8388 (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	2449.9127	0.2160	529.1811 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1226.5135	0.2160	264.9269 (264)
Space and water heating			794.1081 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	372.4349	0.5190	193.2937 (268)
Total kg/year			1026.3268 (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	2449.9127	1.2200	2988.8935 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1226.5135	1.2200	1496.3465 (264)
Space and water heating			4485.2400 (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			5858.8652 (272)
Primary energy kWh/m2/year			74.6162 (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
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	SAP increase too small
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Recommended
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2	Wind turbine
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
U Solar photovoltaic panels	+ 10.8	-£ 605	-1010 kg (98.4%)

Measures omitted - SAP change or cost saving too small:

N Solar water heating	+ 0.9	-£ 43	-141 kg (13.8%)
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Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar photovoltaic panels	£605	12.87 kg/m²	A 95	A 97
Total Savings	£605	12.87 kg/m²		
Potential energy efficiency rating:			A 95	
Potential environmental impact rating:				A 97

Fuel prices for cost data on this page from database revision number 536 TEST (31 Jan 2024)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£139	£139	£0
Mains gas	£385	£385	£0
Space heating	£315	£315	£0
Water heating	£93	£93	£0
Lighting	£116	£116	£0
Generated (PV)	-£0	-£605	£605
Total cost of fuels	£524	-£81	£605
Total cost of uses	£524	-£81	£605
Delivered energy	53 kWh/m²	28 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.0 tonnes	0.0 tonnes	1.0 tonnes
CO2 emissions per m²	13 kg/m²	0 kg/m²	13 kg/m²
Primary energy	75 kWh/m²	-1 kWh/m²	76 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2042 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.4297 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3975 (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	0.5068	0.4968	0.4869	0.4372	0.4273	0.3776	0.3776	0.3676	0.3975	0.4273	0.4471	0.4670 (22b)
Effective ac	0.6284	0.6234	0.6185	0.5956	0.5913	0.5713	0.5713	0.5676	0.5790	0.5913	0.6000	0.6090 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.2100	16.1228	7.4000	568.1350 (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)			167.1810				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8183		(33)
Party Wall			41.7100	0.0000	0.0000	7.4000	308.6540 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8893 (36)
Total fabric heat loss							(33) + (36) = 56.7076 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.6256	40.3033	39.9873	38.5033	38.2257	36.9331	36.9331	36.6938	37.4310	38.2257	38.7874	39.3746 (38)
Heat transfer coeff	97.3332	97.0109	96.6949	95.2109	94.9333	93.6407	93.6407	93.4014	94.1386	94.9333	95.4950	96.0822 (39)
Average = Sum(39)m / 12 =												95.2096 (39)
HLP	1.2396	1.2355	1.2315	1.2126	1.2090	1.1926	1.1926	1.1895	1.1989	1.2090	1.2162	1.2237 (40)
HLP (average)												1.2126 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508	146.0508 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.7220	46.8272	38.0825	28.8309	21.5514	18.1946	19.6599	25.5547	34.2995	43.5511	50.8305	54.1873 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	322.8650	326.2153	317.7726	299.7991	277.1107	255.7868	241.5411	238.1908	246.6335	264.6071	287.2955	308.6193 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393	52.0393 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672	-97.3672 (71)
Water heating gains (Table 5)	67.3040	65.1680	60.7322	54.7059	50.7921	45.2851	40.6096	46.6059	48.7407	54.9770	62.0198	65.1804 (72)
Total internal gains	546.6139	541.9334	520.3101	487.0587	453.1770	422.9893	405.5335	414.0743	433.3965	466.8580	503.8686	531.7099 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c	Access factor Table 6d		Gains W
Southeast					2.5540	36.7938	0.7300		0.7200	0.7700		34.2282 (77)
Northwest					7.2440	11.2829	0.7300		0.7200	0.7700		29.7707 (81)

Solar gains	63.9990	118.9025	188.9536	278.1485	351.7341	366.8665	346.3425	288.7420	219.4155	138.4946	78.4568	53.6045 (83)
Total gains	610.6129	660.8359	709.2637	765.2072	804.9112	789.8558	751.8761	702.8163	652.8121	605.3526	582.3255	585.3144 (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	15.0424	15.0924	15.1417	15.3777	15.4227	15.6355	15.6355	15.6756	15.5528	15.4227	15.3319	15.2382
alpha	2.0028	2.0062	2.0094	2.0252	2.0282	2.0424	2.0424	2.0450	2.0369	2.0282	2.0221	2.0159
util living area	0.9072	0.8889	0.8558	0.7935	0.7002	0.5755	0.4616	0.4995	0.6690	0.8143	0.8843	0.9135 (86)
MIT	18.0760	18.3361	18.8227	19.4957	20.1172	20.5969	20.8192	20.7808	20.4090	19.6331	18.7606	18.0339 (87)
Th 2	19.8885	19.8917	19.8949	19.9100	19.9128	19.9259	19.9259	19.9284	19.9209	19.9128	19.9071	19.9011 (88)
util rest of house	0.8968	0.8764	0.8388	0.7675	0.6590	0.5106	0.3712	0.4101	0.6105	0.7857	0.8693	0.9037 (89)
MIT 2	16.0531	16.4232	17.1143	18.0631	18.9126	19.5399	19.7950	19.7610	19.3183	18.2734	17.0400	15.9967 (90)
Living area fraction									fLA = Living area / (4) =			0.2028 (91)
MIT	16.4632	16.8110	17.4607	18.3536	19.1569	19.7542	20.0027	19.9678	19.5395	18.5491	17.3889	16.4098 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.3132	16.6610	17.3107	18.2036	19.0069	19.6042	19.8527	19.8178	19.3895	18.3991	17.2389	16.2598 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.8484	0.8255	0.7859	0.7170	0.6189	0.4889	0.3644	0.3999	0.5768	0.7344	0.8184	0.8568 (94)
Useful gains	518.0398	545.5318	557.4135	548.6776	498.1423	386.1407	274.0067	281.0884	376.5669	444.5959	476.5555	501.5200 (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	1169.2842	1140.9455	1045.3363	885.8011	693.6632	468.5967	304.5806	319.2276	497.9445	740.3897	968.2105	1158.7289 (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	484.5258	400.1180	363.0145	242.7289	145.4676	0.0000	0.0000	0.0000	0.0000	220.0706	353.9916	488.9635 (98)
Space heating												2698.8805 (98)
Space heating per m2												(98) / (4) = 34.3719 (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												2992.1069	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	484.5258	400.1180	363.0145	242.7289	145.4676	0.0000	0.0000	0.0000	0.0000	220.0706	353.9916	488.9635	(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)	537.1683	443.5898	402.4551	269.1008	161.2722	0.0000	0.0000	0.0000	0.0000	243.9807	392.4519	542.0881	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	102.3331	89.2388	92.5437	82.7828	80.5164	70.7211	67.7280	76.2699	76.7177	87.3884	93.0381	99.1991	(64)
Efficiency of water heater	87.4457	87.3236	87.0074	86.2385	84.7460	76.4000	76.4000	76.4000	76.4000	85.7953	86.9319	76.4000	(216)
(217)m												87.5333	(217)
Fuel for water heating, kWh/month	117.0247	102.1932	106.3630	95.9929	95.0091	92.5669	88.6492	99.8298	100.4158	101.8569	107.0241	113.3272	(219)
Water heating fuel used												1220.2527	(219)
Annual totals kWh/year													
Space heating fuel - main system												2992.1069	(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												2932.5552	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2992.1069	3.4800	104.1253 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1220.2527	3.4800	42.4648 (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			97.7839 (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] =	0.3325 (257)
SAP value	95.3618	
SAP rating (Section 12)	95	(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	2992.1069	0.2160	646.2951	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1220.2527	0.2160	263.5746	(264)
Space and water heating			909.8697	(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			245.6512	(272)
CO2 emissions per m2			3.1300	(273)
EI value			97.3351	
EI rating			97	(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 heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.2042 (8)
Pressure test					Yes
Measured/design AP50					4.5100
Infiltration rate					0.4297 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3975 (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	0.4869	0.4571	0.4471	0.4173	0.4173	0.4074	0.4074	0.3975	0.3975	0.4273	0.4273	0.4372 (22b)
Effective ac	0.6185	0.6045	0.6000	0.5871	0.5871	0.5830	0.5830	0.5790	0.5790	0.5913	0.5913	0.5956 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Solid Door			2.0900	1.2000	2.5080		(26)
Windows (Uw = 1.40)			9.8000	1.3258	12.9792		(27)
Flr - Ground			39.2630	0.1800	7.0673	75.6000	2968.2828 (28a)
Wl - Brick (Timber Frame)	88.6620	11.8870	76.7750	0.2100	16.1228	7.4000	568.1350 (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)			167.1810				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	41.8183		(33)
Party Wall			41.7100	0.0000	0.0000	7.4000	308.6540 (32)
Stud			74.8825			7.4000	554.1306 (32c)
Internal Floor			39.2630			7.4000	290.5462 (32d)
Internal Ceiling			39.2630			7.4000	290.5462 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 5270.8410 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							67.1274 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							14.8893 (36)
Total fabric heat loss							(33) + (36) = 56.7076 (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	39.9873	39.0778	38.7874	37.9544	37.9544	37.6895	37.6895	37.4310	37.4310	38.2257	38.2257	38.5033 (38)
Heat transfer coeff	96.6949	95.7854	95.4950	94.6620	94.6620	94.3971	94.3971	94.1386	94.1386	94.9333	94.9333	95.2109 (39)
Average = Sum(39)m / 12 =												94.9540 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2315	1.2199	1.2162	1.2056	1.2056	1.2022	1.2022	1.1989	1.1989	1.2090	1.2090	1.2126 (40)
HLP (average)												1.2093 (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												

[illegible]

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			
Southeast				2.5540	45.0642	0.7300		0.7200	0.7700		41.9219 (77)	
Northwest				7.2440	14.6130	0.7300		0.7200	0.7700		68.5574 (81)	
Solar gains	80.4793	128.0337	208.6875	311.4907	372.0258	428.3579	390.9133	339.2685	256.1250	163.4515	98.5093	66.1538 (83)
Total gains	627.0932	669.9671	728.9976	798.5494	825.2028	851.3472	796.4468	753.3428	689.5215	630.3095	602.3780	597.8637 (84)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, n _{li} m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	15.1417	15.2854	15.3319	15.4668	15.4668	15.5102	15.5102	15.5528	15.5528	15.4227	15.4227	15.3777
alpha	2.0094	2.0190	2.0221	2.0311	2.0311	2.0340	2.0340	2.0369	2.0369	2.0282	2.0282	2.0252
util living area	0.8889	0.8717	0.8295	0.7513	0.6366	0.4718	0.3537	0.3603	0.5713	0.7551	0.8521	0.8948 (86)
MIT	18.4752	18.6793	19.1659	19.8041	20.3838	20.7788	20.9173	20.9173	20.6561	20.0323	19.2169	18.4814 (87)
Th 2	19.8949	19.9041	19.9071	19.9155	19.9155	19.9182	19.9182	19.9209	19.9209	19.9128	19.9128	19.9100 (88)
util rest of house	0.8757	0.8566	0.8087	0.7193	0.5850	0.3933	0.2499	0.2518	0.4945	0.7144	0.8314	0.8821 (89)
MIT 2	16.6254	16.9161	17.6025	18.4895	19.2627	19.7393	19.8765	19.8806	19.6175	18.8194	17.6888	16.6404 (90)
Living area fraction										fLA = Living area / (4) =		0.2028 (91)
MIT	17.0004	17.2736	17.9195	18.7560	19.4900	19.9501	20.0875	20.0908	19.8280	19.0653	17.9986	17.0136 (92)
Temperature adjustment												-0.1500
adjusted MIT	16.8504	17.1236	17.7695	18.6060	19.3400	19.8001	19.9375	19.9408	19.6780	18.9153	17.8486	16.8636 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8249	0.8047	0.7563	0.6729	0.5539	0.3840	0.2519	0.2539	0.4750	0.6685	0.7792	0.8325 (94)
Useful gains	517.3030	539.0902	551.3301	537.3135	457.0642	326.9397	200.5899	191.2789	327.4997	421.3893	469.3445	497.7077 (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												
	1078.1885	1055.9002	961.5843	805.1947	590.6888	368.1546	211.2122	201.5287	393.3150	628.0099	859.0119	1053.3792 (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												
	417.2988	347.2963	305.2291	192.8745	99.4167	0.0000	0.0000	0.0000	0.0000	153.7257	280.5605	413.4197 (98)
Space heating												2209.8213 (98)
Space heating per m2												28.1434 (99)
										(98) / (4) =		28.1434 (99)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.2000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2449.9127 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	417.2988	347.2963	305.2291	192.8745	99.4167	0.0000	0.0000	0.0000	0.0000	153.7257	280.5605	413.4197	(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)	462.6372	385.0292	338.3915	213.8298	110.2181	0.0000	0.0000	0.0000	0.0000	170.4276	311.0427	458.3367	(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	87.1016	86.9880	86.5623	85.5589	83.4546	76.4000	76.4000	76.4000	76.4000	84.6578	86.3173	87.1536	(216)
Fuel for water heating, kWh/month	117.4870	102.5875	106.9099	96.7554	96.4794	92.5669	88.6492	99.8298	100.4158	103.2255	107.7863	113.8210	(219)
Water heating fuel used													1226.5135 (219)
Annual totals kWh/year													
Space heating fuel - main system													2449.9127 (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													2177.4152 (238)

10a. Fuel costs - using BEDF prices (536)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2449.9127	7.6100	186.4384 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1226.5135	7.6100	93.3377 (247)
Pumps and fans for heating	75.0000	31.0800	23.3100 (249)
Energy for lighting	372.4349	31.0800	115.7528 (250)
Additional standing charges			105.0000 (251)
Energy saving/generation technologies			
PV Unit	-1946.4459	31.0800	-604.9554 (252)
Total energy cost			-81.1166 (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	2449.9127	0.2160	529.1811 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1226.5135	0.2160	264.9269 (264)
Space and water heating			794.1081 (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			16.1213 (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	2449.9127	1.2200	2988.8935 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1226.5135	1.2200	1496.3465 (264)
Space and water heating			4485.2400 (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			-116.7238 (272)
Primary energy kWh/m2/year			-1.4865 (273)