PREDICTED ENERGY ASSESSMENT

Design SAP
elmhurst energy

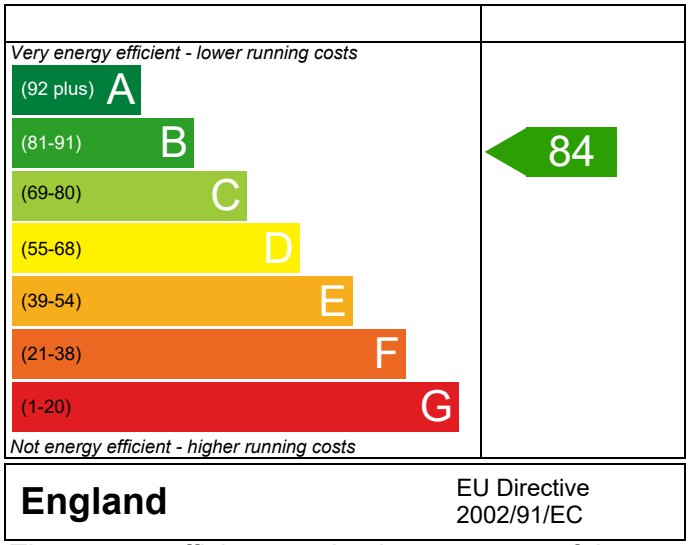
Southbourne,
PO10

Dwelling type:	House, End-Terrace
Date of assessment:	19/09/2023
Produced by:	Gary Nicholls
Total floor area:	79 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

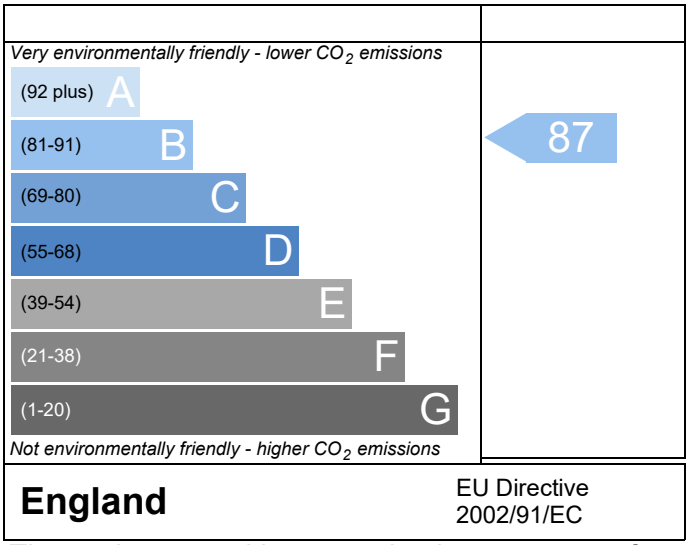
Energy Efficiency Rating



England EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



England EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	037 - PRJ012848	**Issued on Date**	19/09/2023
Assessment Reference	037	**Prop Type Ref**	NSS.860 SAV 4.3
Property	Southbourne, PO10		

SAP Rating	84 B	**DER**	17.32	**TER**	18.77
Environmental	87 B	**% DER<TER**	7.74		
CO_2 Emissions (t/year)	1.12	**DFEE**	41.85	**TFEE**	50.86
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.72		

Assessor Details	Mr. Michael Juckes, Michael Juckes, Tel: 02033971373, michael@briaryenergy.co.uk	**Assessor ID**	W947-0001
Client			

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000	(1b)	x 2.3300	(2b) =	92.0350	(1b) - (3b)
First floor	39.5000	(1c)	x 2.5300	(2c) =	99.9350	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		191.9700	(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) =	0.1563	(8)
Pressure test			Yes	
Measured/design AP50			5.0100	
Infiltration rate			0.4068	(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) =		0.3763	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.4327	0.3951	0.3857	0.3763	0.3951	0.3480	0.3669	0.3480	0.3480	0.3763	0.3669	0.3857	(22b)
Effective ac	0.5936	0.5780	0.5744	0.5708	0.5780	0.5606	0.5673	0.5606	0.5606	0.5708	0.5673	0.5744	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			4.0600	1.2000	4.8720			(26)
Windows (Uw = 1.30)			6.8000	1.2357	8.4030			(27)
Flr - Ground			39.5000	0.1600	6.3200	75.6000	2986.2000	(28a)
Brick	86.7650	10.8580	75.9070	0.2400	18.2177	38.9500	2956.5777	(29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	5.6000	221.2112	(30)
Total net area of external elements Aum(A, m2)			165.7690					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.1579			(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300	(32)
Stud			52.9212			7.4000	391.6165	(32c)
Stud			85.3755			7.4000	631.7789	(32c)
Internal Floor			39.5020			7.4000	292.3148	(32d)
Internal Ceiling			39.5020			7.4000	292.3148	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9322.4439 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		118.0056 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.4340 (36)
Total fabric heat loss	(33) + (36) =	46.5920 (37)

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6057	36.6191	36.3865	36.1595	36.6191	35.5120	35.9381	35.5120	35.5120	36.1595	35.9381	36.3865	(38)
Heat transfer coeff	84.1977	83.2111	82.9785	82.7515	83.2111	82.1040	82.5300	82.1040	82.1040	82.7515	82.5300	82.9785	(39)
Average = Sum(39)m / 12 =												82.7877	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0658	1.0533	1.0504	1.0475	1.0533	1.0393	1.0447	1.0393	1.0393	1.0475	1.0447	1.0504	(40)
HLP (average)												1.0479	(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 2.4436 (42)
Average daily hot water use (litres/day) 92.2358 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6683	13.2271	14.6002	14.0793	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519	14.6541	(61)
Total heat required for water heating calculated for each month	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(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	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(64)
								Total per year (kWh/year) = Sum(64)m =				1622.6634	(64)
RHI water heating demand												1623	(64)
Heat gains from water heating, kWh/month	53.6955	47.0619	48.8014	42.8839	41.3989	36.0939	33.8133	38.2798	38.5828	44.5137	48.1537	52.1133	(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	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.3452	50.9335	41.4219	31.3590	23.4412	19.7901	21.3839	27.7956	37.3072	47.3700	55.2878	58.9390	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	72.1713	70.0326	65.5933	59.5610	55.6436	50.1304	45.4479	51.4514	53.5872	59.8302	66.8802	70.0448	(72)
Total internal gains	557.8789	552.6946	530.2613	496.1079	461.4776	430.8890	413.4876	422.5366	442.6665	477.0305	514.7934	543.0335	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3610	14.6401	0.7600	0.7200	0.7700	18.6591	(74)
South	3.4380	61.3950	0.7600	0.7200	0.7700	80.0420	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	98.7011	136.9143	186.7241	241.8050	269.0433	290.1081	277.7181	248.6142	216.3520	161.1065	112.9832	82.2230	(83)
Total gains	656.5800	689.6089	716.9853	737.9129	730.5209	720.9971	691.2057	671.1508	659.0185	638.1370	627.7767	625.2565	(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	30.7558	31.1205	31.2077	31.2933	31.1205	31.5401	31.3773	31.5401	31.5401	31.2933	31.3773	31.2077	
alpha	3.0504	3.0747	3.0805	3.0862	3.0747	3.1027	3.0918	3.1027	3.1027	3.0862	3.0918	3.0805	
util living area	0.9367	0.9242	0.8930	0.8308	0.7185	0.5384	0.3803	0.3782	0.6158	0.8102	0.9047	0.9412	(86)
MIT	19.5187	19.6622	19.9718	20.3560	20.7037	20.9180	20.9800	20.9812	20.8686	20.5199	20.0042	19.5306	(87)
Th 2	20.0289	20.0391	20.0416	20.0439	20.0391	20.0507	20.0463	20.0507	20.0507	20.0439	20.0463	20.0416	(88)
util rest of house	0.9268	0.9124	0.8757	0.8016	0.6660	0.4563	0.2762	0.2717	0.5382	0.7710	0.8873	0.9318	(89)
MIT 2	18.7052	18.8525	19.1546	19.5213	19.8305	20.0085	20.0405	20.0455	19.9759	19.6779	19.1936	18.7273	(90)

CALCULATION OF HEAT DEMAND 09 Jan 2014

Living area fraction									fLA = Living area / (4) =			0.2267	(91)
MIT	18.8896	19.0361	19.3399	19.7105	20.0284	20.2147	20.2535	20.2576	20.1783	19.8688	19.3774	18.9094	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7396	18.8861	19.1899	19.5605	19.8784	20.0647	20.1035	20.1076	20.0283	19.7188	19.2274	18.7594	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9103	0.8951	0.8573	0.7846	0.6563	0.4576	0.2826	0.2783	0.5362	0.7556	0.8693	0.9159	(94)
Useful gains	597.7047	617.2721	614.6695	578.9824	479.4625	329.9515	195.3602	186.7650	353.3512	482.1958	545.7457	572.6801	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	1131.5863	1097.2280	978.3064	799.4236	572.3613	350.1490	198.3590	189.4667	388.2120	638.7380	893.5843	1100.2446	(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													
	397.2079	322.5304	270.5459	158.7177	69.1167	0.0000	0.0000	0.0000	0.0000	116.4674	250.4438	392.5080	(98)
Space heating												1977.5378	(98)
RHI space heating demand												1978	(98)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3300 (2b)	=	92.0350	(1b) - (3b)
First floor	39.5000 (1c)	x	2.5300 (2c)	=	99.9350	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	191.9700	(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) =	0.1563	(8)
Pressure test				Yes	
Measured/design AP50				5.0100	
Infiltration rate				0.4068	(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) =	0.3763	(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	0.4797	0.4703	0.4609	0.4139	0.4045	0.3575	0.3575	0.3480	0.3763	0.4045	0.4233	0.4421	(22b)
Effective ac	0.6151	0.6106	0.6062	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5977	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			4.0600	1.2000	4.8720			(26)
Windows (Uw = 1.30)			6.8000	1.2357	8.4030			(27)
Flr - Ground			39.5000	0.1600	6.3200	75.6000	2986.2000	(28a)
Brick	86.7650	10.8580	75.9070	0.2400	18.2177	38.9500	2956.5777	(29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	5.6000	221.2112	(30)
Total net area of external elements Aum(A, m2)			165.7690					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.1579			(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300	(32)
Stud			52.9212			7.4000	391.6165	(32c)
Stud			85.3755			7.4000	631.7789	(32c)
Internal Floor			39.5020			7.4000	292.3148	(32d)
Internal Ceiling			39.5020			7.4000	292.3148	(32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		9322.4439	(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							118.0056	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.4340	(36)
Total fabric heat loss					(33) + (36) =		46.5920	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9651	38.6820	38.4045	37.1012	36.8574	35.7223	35.7223	35.5120	36.1595	36.8574	37.3507	37.8664	(38)
Heat transfer coeff	85.5570	85.2740	84.9965	83.6932	83.4494	82.3142	82.3142	82.1040	82.7515	83.4494	83.9426	84.4584	(39)
Average = Sum(39)m / 12 =												83.6920	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0830	1.0794	1.0759	1.0594	1.0563	1.0420	1.0420	1.0393	1.0475	1.0563	1.0626	1.0691	(40)
HLP (average)												1.0594	(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												2.4436	(42)
Average daily hot water use (litres/day)												92.2358	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6683	13.2271	14.6002	14.0793	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519	14.6541	(61)
Total heat required for water heating calculated for each month	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from w/h	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(64)

Total per year (kWh/year) = Sum(64)m = 1622.6634 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat gains from water heating, kWh/month	53.6955	47.0619	48.8014	42.8839	41.3989	36.0939	33.8133	38.2798	38.5828	44.5137	48.1537	52.1133	(65)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts (66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.3452	50.9335	41.4219	31.3590	23.4412	19.7901	21.3839	27.7956	37.3072	47.3700	55.2878	58.9390	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	72.1713	70.0326	65.5933	59.5610	55.6436	50.1304	45.4479	51.4514	53.5872	59.8302	66.8802	70.0448	(72)
Total internal gains	557.8789	552.6946	530.2613	496.1079	461.4776	430.8890	413.4876	422.5366	442.6665	477.0305	514.7934	543.0335	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3610	10.6334	0.7600	0.7200	0.7700	13.5525	(74)
South	3.4380	46.7521	0.7600	0.7200	0.7700	60.9517	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	74.5042	125.7228	171.1667	214.4059	244.9870	246.0669	235.9946	212.2642	185.7444	138.4987	88.9673	63.9659	(83)
Total gains	632.3831	678.4174	701.4280	710.5138	706.4646	676.9559	649.4822	634.8008	628.4109	615.5292	603.7608	606.9994	(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	30.2671	30.3676	30.4668	30.9412	31.0316	31.4595	31.4595	31.5401	31.2933	31.0316	30.8493	30.6609	
alpha	3.0178	3.0245	3.0311	3.0627	3.0688	3.0973	3.0973	3.1027	3.0862	3.0688	3.0566	3.0441	
util living area	0.9505	0.9363	0.9130	0.8679	0.7884	0.6546	0.5132	0.5404	0.7180	0.8654	0.9308	0.9554	(86)
MIT	19.2749	19.4607	19.7633	20.1684	20.5395	20.8233	20.9390	20.9267	20.7474	20.2955	19.7312	19.2437	(87)
Th 2	20.0147	20.0177	20.0206	20.0341	20.0367	20.0485	20.0485	20.0507	20.0439	20.0367	20.0315	20.0262	(88)
util rest of house	0.9429	0.9265	0.8989	0.8450	0.7484	0.5859	0.4174	0.4467	0.6565	0.8380	0.9186	0.9485	(89)
MIT 2	18.4553	18.6393	18.9372	19.3380	19.6857	19.9389	20.0216	20.0166	19.8767	19.4656	18.9178	18.4333	(90)

Living area fraction fLA = Living area / (4) = 0.2267 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
MIT	18.6411	18.8255	19.1244	19.5263	19.8793	20.1394	20.2296	20.2229	20.0741	19.6538	19.1022	18.6170	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.4911	18.6755	18.9744	19.3763	19.7293	19.9894	20.0796	20.0729	19.9241	19.5038	18.9522	18.4670	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9278	0.9098	0.8807	0.8266	0.7339	0.5812	0.4208	0.4491	0.6479	0.8200	0.9016	0.9343	(94)
Useful gains	586.7441	617.2300	617.7511	587.3243	518.4821	393.4453	273.2812	285.0593	407.1262	504.7572	544.3604	567.1493	(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	1214.1482	1174.6946	1060.2836	876.7920	670.0358	443.6260	286.4204	301.5600	481.9541	743.0137	994.9056	1204.9659	(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	466.7886	374.6162	329.2442	208.4167	112.7560	0.0000	0.0000	0.0000	0.0000	177.2628	324.3925	474.5355	(98)

Space heating 2468.0126 (98)

Space heating per m2 (98) / (4) = 31.2407 (99)

8c. Space cooling requirement

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 %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2727.0857	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	466.7886	374.6162	329.2442	208.4167	112.7560	0.0000	0.0000	0.0000	0.0000	177.2628	324.3925	474.5355	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	515.7885	413.9405	363.8058	230.2947	124.5922	0.0000	0.0000	0.0000	0.0000	195.8705	358.4448	524.3487	(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													
	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6414	89.5845	89.4717	89.2290	88.7694	87.3000	87.3000	87.3000	87.3000	89.0738	89.4709	89.6698	(217)
Fuel for water heating, kWh/month													
	184.2114	161.6592	168.0911	148.4580	144.3163	128.3246	120.5930	135.9931	136.9109	154.3544	165.7909	178.8427	(219)
Water heating fuel used												1827.5456	(219)
Annual totals kWh/year													
Space heating fuel - main system												2727.0857	(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)												405.0935	(232)
Total delivered energy for all uses												5034.7248	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2727.0857	3.4800	94.9026	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1827.5456	3.4800	63.5986	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	405.0935	13.1900	53.4318	(250)
Additional standing charges			120.0000	(251)
Total energy cost			341.8255	(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] =	1.1578	(257)
SAP value		83.8487	
SAP rating (Section 12)		84	(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	2727.0857	0.2160	589.0505	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1827.5456	0.2160	394.7498	(264)
Space and water heating			983.8004	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	405.0935	0.5190	210.2435	(268)
Total kg/year			1232.9689	(272)
CO2 emissions per m2			15.6100	(273)
EI value			86.6760	
EI rating			87	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9050 = 3.845, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9050 = 0.2387, stars = 4
Water heating energy efficiency	3.48 / 0.8868 = 3.924, stars = 4
Water heating environmental impact	0.216 / 0.8868 = 0.2436, stars = 4

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

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3300 (2b)	=	92.0350	(1b) - (3b)
First floor	39.5000 (1c)	x	2.5300 (2c)	=	99.9350	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	191.9700	(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) =	0.1563	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4068	(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) =	0.3763	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.4327	0.3951	0.3857	0.3763	0.3951	0.3480	0.3669	0.3480	0.3480	0.3763	0.3669	0.3857	(22b)
Effective ac	0.5936	0.5780	0.5744	0.5708	0.5780	0.5606	0.5673	0.5606	0.5606	0.5708	0.5673	0.5744	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			4.0600	1.2000	4.8720			(26)
Windows (Uw = 1.30)			6.8000	1.2357	8.4030			(27)
Flr - Ground			39.5000	0.1600	6.3200	75.6000	2986.2000	(28a)
Brick	86.7650	10.8580	75.9070	0.2400	18.2177	38.9500	2956.5777	(29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	5.6000	221.2112	(30)
Total net area of external elements Aum(A, m2)			165.7690					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.1579			(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300	(32)
Stud			52.9212			7.4000	391.6165	(32c)
Stud			85.3755			7.4000	631.7789	(32c)
Internal Floor			39.5020			7.4000	292.3148	(32d)
Internal Ceiling			39.5020			7.4000	292.3148	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9322.4439 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		118.0056 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.4340 (36)
Total fabric heat loss	(33) + (36) =	46.5920 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6057	36.6191	36.3865	36.1595	36.6191	35.5120	35.9381	35.5120	35.5120	36.1595	35.9381	36.3865	(38)
Heat transfer coeff	84.1977	83.2111	82.9785	82.7515	83.2111	82.1040	82.5300	82.1040	82.1040	82.7515	82.5300	82.9785	(39)
Average = Sum(39)m / 12 =												82.7877	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0658	1.0533	1.0504	1.0475	1.0533	1.0393	1.0447	1.0393	1.0393	1.0475	1.0447	1.0504	(40)
HLP (average)												1.0479	(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	2.4436 (42)
Average daily hot water use (litres/day)	92.2358 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss (46)m = 0.15 x (45)m	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6683	13.2271	14.6002	14.0793	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519	14.6541	(61)
Total heat required for water heating calculated for each month	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Output from w/h	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(64)

Total per year (kWh/year) = Sum(64)m = 1622.6634 (64)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Heat gains from water heating, kWh/month	53.6955	47.0619	48.8014	42.8839	41.3989	36.0939	33.8133	38.2798	38.5828	44.5137	48.1537	52.1133	(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	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.3452	50.9335	41.4219	31.3590	23.4412	19.7901	21.3839	27.7956	37.3072	47.3700	55.2878	58.9390	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	72.1713	70.0326	65.5933	59.5610	55.6436	50.1304	45.4479	51.4514	53.5872	59.8302	66.8802	70.0448	(72)
Total internal gains	557.8789	552.6946	530.2613	496.1079	461.4776	430.8890	413.4876	422.5366	442.6665	477.0305	514.7934	543.0335	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3610	14.6401	0.7600	0.7200	0.7700	18.6591	(74)
South	3.4380	61.3950	0.7600	0.7200	0.7700	80.0420	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	98.7011	136.9143	186.7241	241.8050	269.0433	290.1081	277.7181	248.6142	216.3520	161.1065	112.9832	82.2230	(83)
Total gains	656.5800	689.6089	716.9853	737.9129	730.5209	720.9971	691.2057	671.1508	659.0185	638.1370	627.7767	625.2565	(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	30.7558	31.1205	31.2077	31.2933	31.1205	31.5401	31.3773	31.5401	31.5401	31.2933	31.3773	31.2077	
alpha	3.0504	3.0747	3.0805	3.0862	3.0747	3.1027	3.0918	3.1027	3.1027	3.0862	3.0918	3.0805	
util living area	0.9367	0.9242	0.8930	0.8308	0.7185	0.5384	0.3803	0.3782	0.6158	0.8102	0.9047	0.9412	(86)
MIT	19.5187	19.6622	19.9718	20.3560	20.7037	20.9180	20.9800	20.9812	20.8686	20.5199	20.0042	19.5306	(87)
Th 2	20.0289	20.0391	20.0416	20.0439	20.0391	20.0507	20.0463	20.0507	20.0507	20.0439	20.0463	20.0416	(88)
util rest of house	0.9268	0.9124	0.8757	0.8016	0.6660	0.4563	0.2762	0.2717	0.5382	0.7710	0.8873	0.9318	(89)
MIT 2	18.7052	18.8525	19.1546	19.5213	19.8305	20.0085	20.0405	20.0455	19.9759	19.6779	19.1936	18.7273	(90)

Living area fraction fLA = Living area / (4) = 0.2267 (91)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
MIT	18.8896	19.0361	19.3399	19.7105	20.0284	20.2147	20.2535	20.2576	20.1783	19.8688	19.3774	18.9094	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.7396	18.8861	19.1899	19.5605	19.8784	20.0647	20.1035	20.1076	20.0283	19.7188	19.2274	18.7594	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9103	0.8951	0.8573	0.7846	0.6563	0.4576	0.2826	0.2783	0.5362	0.7556	0.8693	0.9159	(94)
Useful gains	597.7047	617.2721	614.6695	578.9824	479.4625	329.9515	195.3602	186.7650	353.3512	482.1958	545.7457	572.6801	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1131.5863	1097.2280	978.3064	799.4236	572.3613	350.1490	198.3590	189.4667	388.2120	638.7380	893.5843	1100.2446	(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	397.2079	322.5304	270.5459	158.7177	69.1167	0.0000	0.0000	0.0000	0.0000	116.4674	250.4438	392.5080	(98)

Space heating 1977.5378 (98)

Space heating per m2 (98) / (4) = 25.0321 (99)

8c. Space cooling requirement

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

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 %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2185.1246	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	397.2079	322.5304	270.5459	158.7177	69.1167	0.0000	0.0000	0.0000	0.0000	116.4674	250.4438	392.5080	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	438.9037	356.3871	298.9458	175.3786	76.3721	0.0000	0.0000	0.0000	0.0000	128.6933	276.7335	433.7105	(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													
	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.5363	89.4836	89.3301	89.0156	88.3953	87.3000	87.3000	87.3000	87.3000	88.7390	89.2827	89.5479	(217)
Fuel for water heating, kWh/month													
	184.4277	161.8414	168.3574	148.8138	144.9270	128.3246	120.5930	135.9931	136.9109	154.9367	166.1405	179.0861	(219)
Water heating fuel used												1830.3523	(219)
Annual totals kWh/year													
Space heating fuel - main system												2185.1246	(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)												405.0935	(232)
Total delivered energy for all uses												4495.5704	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2185.1246	10.2300	223.5382	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1830.3523	10.2300	187.2450	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Energy for lighting	405.0935	36.7200	148.7503	(250)
Additional standing charges			103.0000	(251)
Total energy cost			690.0736	(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	2185.1246	0.2160	471.9869	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1830.3523	0.2160	395.3561	(264)
Space and water heating			867.3430	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	405.0935	0.5190	210.2435	(268)
Total kg/year			1116.5115	(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	2185.1246	1.2200	2665.8520	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1830.3523	1.2200	2233.0298	(264)
Space and water heating			4898.8818	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	405.0935	3.0700	1243.6369	(268)
Primary energy kWh/year			6372.7688	(272)
Primary energy kWh/m2/year			80.6680	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
Current environmental impact rating:	B 87

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

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 82	-187 kg (16.7%)
U Solar photovoltaic panels	+ 10.8	-£ 746	-1054 kg (113.4%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£82	2.36 kg/m²	B 85	B 89
Solar photovoltaic panels	£746	13.35 kg/m²	A 96	A 98
Total Savings	£828	15.71 kg/m²		

Potential energy efficiency rating:	A 96
Potential environmental impact rating:	A 98

Fuel prices for cost data on this page from database revision number 526 TEST (30 Aug 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£176	£195	-£18
Mains gas	£514	£413	£101
Space heating	£354	£354	£0
Water heating	£187	£105	£82
Lighting	£149	£149	£0
Generated (PV)	-£0	-£746	£746
Total cost of fuels	£690	-£138	£829
Total cost of uses	£690	-£138	£828
Delivered energy	57 kWh/m²	19 kWh/m²	38 kWh/m²
Carbon dioxide emissions	1.1 tonnes	-0.1 tonnes	1.2 tonnes
CO2 emissions per m²	14 kg/m²	-2 kg/m²	16 kg/m²
Primary energy	81 kWh/m²	-12 kWh/m²	92 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3300 (2b)	=	92.0350	(1b) - (3b)
First floor	39.5000 (1c)	x	2.5300 (2c)	=	99.9350	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	191.9700	(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) =	0.1563	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4068	(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) =	0.3763	(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	0.4797	0.4703	0.4609	0.4139	0.4045	0.3575	0.3575	0.3480	0.3763	0.4045	0.4233	0.4421	(22b)
Effective ac	0.6151	0.6106	0.6062	0.5857	0.5818	0.5639	0.5639	0.5606	0.5708	0.5818	0.5896	0.5977	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			4.0600	1.2000	4.8720			(26)
Windows (Uw = 1.30)			6.8000	1.2357	8.4030			(27)
Flr - Ground			39.5000	0.1600	6.3200	75.6000	2986.2000	(28a)
Brick	86.7650	10.8580	75.9070	0.2400	18.2177	38.9500	2956.5777	(29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	5.6000	221.2112	(30)
Total net area of external elements Aum(A, m2)			165.7690					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.1579			(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300	(32)
Stud			52.9212			7.4000	391.6165	(32c)
Stud			85.3755			7.4000	631.7789	(32c)
Internal Floor			39.5020			7.4000	292.3148	(32d)
Internal Ceiling			39.5020			7.4000	292.3148	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9322.4439 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		118.0056 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.4340 (36)
Total fabric heat loss	(33) + (36) =	46.5920 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.9651	38.6820	38.4045	37.1012	36.8574	35.7223	35.7223	35.5120	36.1595	36.8574	37.3507	37.8664	(38)
Heat transfer coeff	85.5570	85.2740	84.9965	83.6932	83.4494	82.3142	82.3142	82.1040	82.7515	83.4494	83.9426	84.4584	(39)
Average = Sum(39)m / 12 =												83.6920	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0830	1.0794	1.0759	1.0594	1.0563	1.0420	1.0420	1.0393	1.0475	1.0563	1.0626	1.0691	(40)
HLP (average)												1.0594	(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	2.4436 (42)
Average daily hot water use (litres/day)	92.2358 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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Distribution loss  (46)m = 0.15 x (45)m
                22.5692    19.7392    20.3691    17.7582    17.0394    14.7037    13.6252    15.6351    15.8218    18.4388    20.1274    21.8571 (46)
Water storage loss:
Total storage loss
                 0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (56)
If cylinder contains dedicated solar storage
                 0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (57)
Combi loss      14.6683    13.2271    14.6002    14.0793    14.5124    14.0024    14.4431    14.4880    14.0443    14.5639    14.1519    14.6541 (61)
Total heat required for water heating calculated for each month
               165.1296   144.8215   150.3939   132.4676   128.1087   112.0274   105.2777   118.7220   119.5232   137.4893   148.3346   160.3678 (62)
Aperture area of solar collector                                                                                                    3.0000 (H1)
Zero-loss collector efficiency                                                                                                      0.7000 (H2)
Collector heat loss coefficient                                                                                                     1.8000 (H3)
Collector 2nd order heat loss coefficient                                                                                           0.0050 (H3a)
Collector effective heat loss coefficient                                                                                           1.8063 (H3b)
Collector performance ratio                                                                                                         2.5804 (H4)
Annual solar radiation per m2                                                                                                    1079.5246 (H5)
Overshading factor                                                                                                                  0.8000 (H6)
Solar energy available                                                                                                           1813.6014 (H7)
Adjustment factor for showers                                                                                                       1.0000 (H7a)
Solar-to-load ratio                                                                                                                 1.2497 (H8)
Utilisation factor                                                                                                                  0.5508 (H9)
Collector performance factor                                                                                                        0.8793 (H10)
Dedicated solar storage volume                                                                                                     75.0000 (H11)
Effective solar volume                                                                                                             75.0000 (H13)
Daily hot water demand                                                                                                             92.2358 (H14)
Volume ratio Veff/V                                                                                                                 0.8131 (H15)
Solar storage volume factor                                                                                                         0.9586 (H16)
Solar input                                                                                                                      -841.9491 (H17)
Solar input     -24.4148   -40.7414   -69.3872   -92.9925  -114.8844  -112.9497  -111.4570   -97.3806   -76.2685   -52.0824   -28.9595   -20.4311 (63)
                                                                                      Solar input (sum of months) = Sum(63)m =   -841.9491 (63)
Output from w/h
               140.7148   104.0802    81.0067    39.4750    13.2243     0.0000     0.0000    21.3415    43.2547    85.4069   119.3751   139.9368 (64)
                                                                                        Total per year (kWh/year) = Sum(64)m =    787.8159 (64)
Heat gains from water heating, kWh/month
                53.6955    47.0619    48.8014    42.8839    41.3989    36.0939    33.8133    38.2798    38.5828    44.5137    48.1537    52.1133 (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          146.6168   146.6168   146.6168   146.6168   146.6168   146.6168   146.6168   146.6168   146.6168   146.6168   146.6168   146.6168 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                57.3452    50.9335    41.4219    31.3590    23.4412    19.7901    21.3839    27.7956    37.3072    47.3700    55.2878    58.9390 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               324.3849   327.7510   319.2685   301.2103   278.4152   256.9909   242.6782   239.3121   247.7945   265.8527   288.6479   310.0721 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                52.1053    52.1053    52.1053    52.1053    52.1053    52.1053    52.1053    52.1053    52.1053    52.1053    52.1053    52.1053 (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)
               -97.7445   -97.7445   -97.7445   -97.7445   -97.7445   -97.7445   -97.7445   -97.7445   -97.7445   -97.7445   -97.7445   -97.7445 (71)
Water heating gains (Table 5)
                72.1713    70.0326    65.5933    59.5610    55.6436    50.1304    45.4479    51.4514    53.5872    59.8302    66.8802    70.0448 (72)
Total internal gains
               557.8789   552.6946   530.2613   496.1079   461.4776   430.8890   413.4876   422.5366   442.6665   477.0305   514.7934   543.0335 (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
-----------------------------------------------------------------------------------------------------
North                                        3.3610           10.6334           0.7600           0.7200           0.7700            13.5525 (74)
South                                        3.4380           46.7521           0.7600           0.7200           0.7700            60.9517 (78)
-----------------------------------------------------------------------------------------------------

Solar gains     74.5042   125.7228   171.1667   214.4059   244.9870   246.0669   235.9946   212.2642   185.7444   138.4987    88.9673    63.9659 (83)
Total gains    632.3831   678.4174   701.4280   710.5138   706.4646   676.9559   649.4822   634.8008   628.4109   615.5292   603.7608   606.9994 (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             30.2671    30.3676    30.4668    30.9412    31.0316    31.4595    31.4595    31.5401    31.2933    31.0316    30.8493    30.6609
alpha            3.0178     3.0245     3.0311     3.0627     3.0688     3.0973     3.0973     3.1027     3.0862     3.0688     3.0566     3.0441
util living area
                 0.9505     0.9363     0.9130     0.8679     0.7884     0.6546     0.5132     0.5404     0.7180     0.8654     0.9308     0.9554 (86)

MIT             19.2749    19.4607    19.7633    20.1684    20.5395    20.8233    20.9390    20.9267    20.7474    20.2955    19.7312    19.2437 (87)
Th 2            20.0147    20.0177    20.0206    20.0341    20.0367    20.0485    20.0485    20.0507    20.0439    20.0367    20.0315    20.0262 (88)
util rest of house
                 0.9429     0.9265     0.8989     0.8450     0.7484     0.5859     0.4174     0.4467     0.6565     0.8380     0.9186     0.9485 (89)
MIT 2           18.4553    18.6393    18.9372    19.3380    19.6857    19.9389    20.0216    20.0166    19.8767    19.4656    18.9178    18.4333 (90)
Living area fraction                                                                    fLA = Living area / (4) =           0.2267 (91)
MIT             18.6411    18.8255    19.1244    19.5263    19.8793    20.1394    20.2296    20.2229    20.0741    19.6538    19.1022    18.6170 (92)
Temperature adjustment                                                                                                             -0.1500
adjusted MIT    18.4911    18.6755    18.9744    19.3763    19.7293    19.9894    20.0796    20.0729    19.9241    19.5038    18.9522    18.4670 (93)


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8. Space heating requirement
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9278	0.9098	0.8807	0.8266	0.7339	0.5812	0.4208	0.4491	0.6479	0.8200	0.9016	0.9343	(94)
Useful gains	586.7441	617.2300	617.7511	587.3243	518.4821	393.4453	273.2812	285.0593	407.1262	504.7572	544.3604	567.1493	(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	1214.1482	1174.6946	1060.2836	876.7920	670.0358	443.6260	286.4204	301.5600	481.9541	743.0137	994.9056	1204.9659	(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	466.7886	374.6162	329.2442	208.4167	112.7560	0.0000	0.0000	0.0000	0.0000	177.2628	324.3925	474.5355	(98)

Space heating 2468.0126 (98)
Space heating per m2 (98) / (4) = 31.2407 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 90.5000 (206)
Efficiency of secondary/supplementary heating system, % 0.0000 (208)
Space heating requirement 2727.0857 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	466.7886	374.6162	329.2442	208.4167	112.7560	0.0000	0.0000	0.0000	0.0000	177.2628	324.3925	474.5355	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	515.7885	413.9405	363.8058	230.2947	124.5922	0.0000	0.0000	0.0000	0.0000	195.8705	358.4448	524.3487	(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	140.7148	104.0802	81.0067	39.4750	13.2243	0.0000	0.0000	21.3415	43.2547	85.4069	119.3751	139.9368	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7381	89.7844	89.8497	89.9748	90.1531	87.3000	87.3000	87.3000	87.3000	89.4341	89.6163	89.7508	(217)
Fuel for water heating, kWh/month	156.8061	115.9223	90.1580	43.8734	14.6687	0.0000	0.0000	24.4461	49.5472	95.4970	133.2068	155.9170	(219)

Water heating fuel used 880.0427 (219)
Annual totals kWh/year
Space heating fuel - main system 2727.0857 (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)
pump for solar water heating 50.0000 (230g)
Total electricity for the above, kWh/year 125.0000 (231)
Electricity for lighting (calculated in Appendix L) 405.0935 (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 2409.9825 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2727.0857	3.4800	94.9026	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	880.0427	3.4800	30.6255	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	405.0935	13.1900	53.4318	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			87.6245	(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] = 0.2968 (257)
SAP value 95.8597
SAP rating (Section 12) 96 (258)
SAP band A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	2727.0857	0.2160	589.0505 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	880.0427	0.2160	190.0892 (264)
Space and water heating			779.1397 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	405.0935	0.5190	210.2435 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			157.8210 (272)
CO2 emissions per m2			2.0000 (273)
EI value			98.2945
EI rating			98 (274)
EI band			A

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

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

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	39.5000 (1b)	x	2.3300 (2b)	=	92.0350	(1b) - (3b)
First floor	39.5000 (1c)	x	2.5300 (2c)	=	99.9350	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	79.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	191.9700	(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) =	0.1563	(8)
Pressure test				Yes	
Measured/design AP50				5.0100	
Infiltration rate				0.4068	(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) =	0.3763	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.4327	0.3951	0.3857	0.3763	0.3951	0.3480	0.3669	0.3480	0.3480	0.3763	0.3669	0.3857	(22b)
Effective ac	0.5936	0.5780	0.5744	0.5708	0.5780	0.5606	0.5673	0.5606	0.5606	0.5708	0.5673	0.5744	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			4.0600	1.2000	4.8720			(26)
Windows (Uw = 1.30)			6.8000	1.2357	8.4030			(27)
Flr - Ground			39.5000	0.1600	6.3200	75.6000	2986.2000	(28a)
Brick	86.7650	10.8580	75.9070	0.2400	18.2177	38.9500	2956.5777	(29a)
Rf - Ins Joist	39.5020		39.5020	0.1100	4.3452	5.6000	221.2112	(30)
Total net area of external elements Aum(A, m2)			165.7690					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		42.1579			(33)
Party Wall			39.3810	0.0000	0.0000	39.3700	1550.4300	(32)
Stud			52.9212			7.4000	391.6165	(32c)
Stud			85.3755			7.4000	631.7789	(32c)
Internal Floor			39.5020			7.4000	292.3148	(32d)
Internal Ceiling			39.5020			7.4000	292.3148	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	9322.4439 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		118.0056 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		4.4340 (36)
Total fabric heat loss	(33) + (36) =	46.5920 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	37.6057	36.6191	36.3865	36.1595	36.6191	35.5120	35.9381	35.5120	35.5120	36.1595	35.9381	36.3865	(38)
Heat transfer coeff	84.1977	83.2111	82.9785	82.7515	83.2111	82.1040	82.5300	82.1040	82.1040	82.7515	82.5300	82.9785	(39)
Average = Sum(39)m / 12 =												82.7877	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.0658	1.0533	1.0504	1.0475	1.0533	1.0393	1.0447	1.0393	1.0393	1.0475	1.0447	1.0504	(40)
HLP (average)												1.0479	(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	2.4436 (42)
Average daily hot water use (litres/day)	92.2358 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	101.4594	97.7700	94.0805	90.3911	86.7017	83.0122	83.0122	86.7017	90.3911	94.0805	97.7700	101.4594	(44)
Energy conte	150.4613	131.5945	135.7937	118.3882	113.5963	98.0250	90.8346	104.2340	105.4789	122.9255	134.1828	145.7138	(45)
Energy content (annual)										Total = Sum(45)m =		1451.2285	(45)

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

Distribution loss (46)m = 0.15 x (45)m

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Distribution loss	22.5692	19.7392	20.3691	17.7582	17.0394	14.7037	13.6252	15.6351	15.8218	18.4388	20.1274	21.8571	(46)
Water storage loss: Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.6683	13.2271	14.6002	14.0793	14.5124	14.0024	14.4431	14.4880	14.0443	14.5639	14.1519	14.6541	(61)
Total heat required for water heating calculated for each month	165.1296	144.8215	150.3939	132.4676	128.1087	112.0274	105.2777	118.7220	119.5232	137.4893	148.3346	160.3678	(62)

Aperture area of solar collector	3.0000	(H1)
Zero-loss collector efficiency	0.7000	(H2)
Collector heat loss coefficient	1.8000	(H3)
Collector 2nd order heat loss coefficient	0.0050	(H3a)
Collector effective heat loss coefficient	1.8063	(H3b)
Collector performance ratio	2.5804	(H4)
Annual solar radiation per m2	1269.6808	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	2133.0637	(H7)
Adjustment factor for showers	1.0000	(H7a)
Solar-to-load ratio	1.4698	(H8)
Utilisation factor	0.4936	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	92.2358	(H14)
Volume ratio Veff/V	0.8131	(H15)
Solar storage volume factor	0.9586	(H16)
Solar input	-887.4168	(H17)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar input	-29.8875	-41.0151	-69.6829	-95.5751	-113.9554	-119.8490	-118.2226	-103.5289	-81.4909	-55.9584	-33.9958	-24.2551	(63)
Output from w/h	135.2422	103.8064	80.7109	36.8924	14.1533	0.0000	0.0000	15.1931	38.0323	81.5309	114.3388	136.1127	(64)
Heat gains from water heating, kWh/month	53.6955	47.0619	48.8014	42.8839	41.3989	36.0939	33.8133	38.2798	38.5828	44.5137	48.1537	52.1133	(65)

Solar input (sum of months) = Sum(63)m = -887.4168 (63)

Output from w/h: Total per year (kWh/year) = Sum(64)m = 756.0131 (64)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts (66)m	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	146.6168	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	57.3452	50.9335	41.4219	31.3590	23.4412	19.7901	21.3839	27.7956	37.3072	47.3700	55.2878	58.9390	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	324.3849	327.7510	319.2685	301.2103	278.4152	256.9909	242.6782	239.3121	247.7945	265.8527	288.6479	310.0721	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	52.1053	(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)	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	-97.7445	(71)
Water heating gains (Table 5)	72.1713	70.0326	65.5933	59.5610	55.6436	50.1304	45.4479	51.4514	53.5872	59.8302	66.8802	70.0448	(72)
Total internal gains	557.8789	552.6946	530.2613	496.1079	461.4776	430.8890	413.4876	422.5366	442.6665	477.0305	514.7934	543.0335	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.3610	14.6401	0.7600	0.7200	0.7700	18.6591	(74)
South	3.4380	61.3950	0.7600	0.7200	0.7700	80.0420	(78)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Solar gains	98.7011	136.9143	186.7241	241.8050	269.0433	290.1081	277.7181	248.6142	216.3520	161.1065	112.9832	82.2230	(83)
Total gains	656.5800	689.6089	716.9853	737.9129	730.5209	720.9971	691.2057	671.1508	659.0185	638.1370	627.7767	625.2565	(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	30.7558	31.1205	31.2077	31.2933	31.1205	31.5401	31.3773	31.5401	31.5401	31.2933	31.3773	31.2077	
alpha	3.0504	3.0747	3.0805	3.0862	3.0747	3.1027	3.0918	3.1027	3.1027	3.0862	3.0918	3.0805	
util living area	0.9367	0.9242	0.8930	0.8308	0.7185	0.5384	0.3803	0.3782	0.6158	0.8102	0.9047	0.9412	(86)
MIT	19.5187	19.6622	19.9718	20.3560	20.7037	20.9180	20.9800	20.9812	20.8686	20.5199	20.0042	19.5306	(87)
Th 2	20.0289	20.0391	20.0416	20.0439	20.0391	20.0507	20.0463	20.0507	20.0507	20.0439	20.0463	20.0416	(88)
util rest of house	0.9268	0.9124	0.8757	0.8016	0.6660	0.4563	0.2762	0.2717	0.5382	0.7710	0.8873	0.9318	(89)
MIT 2	18.7052	18.8525	19.1546	19.5213	19.8305	20.0085	20.0405	20.0455	19.9759	19.6779	19.1936	18.7273	(90)
MIT	18.8896	19.0361	19.3399	19.7105	20.0284	20.2147	20.2535	20.2576	20.1783	19.8688	19.3774	18.9094	(92)
adjusted MIT	18.7396	18.8861	19.1899	19.5605	19.8784	20.0647	20.1035	20.1076	20.0283	19.7188	19.2274	18.7594	(93)

Living area fraction: fLA = Living area / (4) = 0.2267 (91)

Temperature adjustment -0.1500

8. Space heating requirement

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9103	0.8951	0.8573	0.7846	0.6563	0.4576	0.2826	0.2783	0.5362	0.7556	0.8693	0.9159	(94)
Useful gains	597.7047	617.2721	614.6695	578.9824	479.4625	329.9515	195.3602	186.7650	353.3512	482.1958	545.7457	572.6801	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1131.5863	1097.2280	978.3064	799.4236	572.3613	350.1490	198.3590	189.4667	388.2120	638.7380	893.5843	1100.2446	(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	397.2079	322.5304	270.5459	158.7177	69.1167	0.0000	0.0000	0.0000	0.0000	116.4674	250.4438	392.5080	(98)
Space heating												1977.5378	(98)
Space heating per m2											(98) / (4) =	25.0321	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												2185.1246	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	397.2079	322.5304	270.5459	158.7177	69.1167	0.0000	0.0000	0.0000	0.0000	116.4674	250.4438	392.5080	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	438.9037	356.3871	298.9458	175.3786	76.3721	0.0000	0.0000	0.0000	0.0000	128.6933	276.7335	433.7105	(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	135.2422	103.8064	80.7109	36.8924	14.1533	0.0000	0.0000	15.1931	38.0323	81.5309	114.3388	136.1127	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6652	89.6994	89.7441	89.8786	89.9397	87.3000	87.3000	87.3000	87.3000	89.1543	89.4720	89.6538	(217)
Fuel for water heating, kWh/month	150.8302	115.7270	89.9345	41.0469	15.7365	0.0000	0.0000	17.4033	43.5650	91.4492	127.7928	151.8203	(219)
Water heating fuel used												845.3057	(219)
Annual totals kWh/year													
Space heating fuel - main system												2185.1246	(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)
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												125.0000	(231)
Electricity for lighting (calculated in Appendix L)												405.0935	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1270 * 0.80) =										-2031.4892		-2031.4892	(233)
Total delivered energy for all uses												1529.0346	(238)

10a. Fuel costs - using BEDF prices (526)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2185.1246	10.2300	223.5382	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	845.3057	10.2300	86.4748	(247)
Pumps and fans for heating	75.0000	36.7200	27.5400	(249)
Pump for solar water heating	50.0000	36.7200	18.3600	(249)
Energy for lighting	405.0935	36.7200	148.7503	(250)
Additional standing charges			103.0000	(251)
Energy saving/generation technologies				
PV Unit	-2031.4892	36.7200	-745.9628	(252)
Total energy cost			-138.2995	(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	2185.1246	0.2160	471.9869	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	845.3057	0.2160	182.5860	(264)
Space and water heating			654.5730	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	405.0935	0.5190	210.2435	(268)
Energy saving/generation technologies				
PV Unit	-2031.4892	0.5190	-1054.3429	(269)
Total kg/year			-124.6514	(272)

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

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	2185.1246	1.2200	2665.8520	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	845.3057	1.2200	1031.2730	(264)
Space and water heating			3697.1250	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	405.0935	3.0700	1243.6369	(268)
Energy saving/generation technologies				
PV Unit	-2031.4892	3.0700	-6236.6719	(269)
Primary energy kWh/year			-912.1599	(272)
Primary energy kWh/m2/year			-11.5463	(273)

BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	037 - PRJ012848	**Issued on Date**	19/09/2023
Assessment Reference	037	**Prop Type Ref**	NSS.860 SAV 4.3
Property	Southbourne, PO10		

SAP Rating	84 B	**DER**	17.32	**TER**	18.77
Environmental	87 B	**% DER<TER**	7.74		
CO_2 Emissions (t/year)	1.12	**DFEE**	41.85	**TFEE**	50.86
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.72		

Assessor Details	Mr. Michael Juckes, Michael Juckes, Tel: 02033971373, michael@briaryenergy.co.uk	**Assessor ID**	W947-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	18.77	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	17.32	$kgCO_2/m^2$	Pass
	-1.45 (-7.7%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	50.86	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	41.85	$kWh/m^2/yr$	
	-9.1 (-17.9%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.26 (max. 2.00)	1.30 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 30 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Programmer, room thermostat and TRVs		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

Percentage of fixed lights with low-energy fittings	100	%	
Minimum	75	%	Pass

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing South	3.36 m², No overhang 3.44 m², No overhang		
Air change rate	4.68 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
Filled Cavity with Edge Sealing	0.00	W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)		
Maximum	10.0		Pass

10 Key features

Party wall U-value	0.00	W/m²K
Roof U-value	0.11	W/m²K
Thermal bridging y-value	0.027	W/m²K