elmhurst energy

SAP Report Submission for Building Regulations Compliance

Client: Sterling Rose Ltd

Project: 3, IRIS MEWS
SUTTON, SM1 4GG

Contact: Carlos Val Escudero
Carlos Val
[redacted]

Report Issue Date: 03/06/2021

EXCELLENCE IN ENERGY ASSESSMENT

FULL SAP CALCULATION PRINTOUT
Calculation Type: Conversion (As Built)

Design SAP
elmhurst energy

Property Reference	19686 - Unit 3	Issued on Date	03/06/2021
Assessment Reference	As built	Prop Type Ref	
Property	3, IRIS MEWS, SUTTON, SM1 4GG		

SAP Rating	84 B	DER	N/A	TER	N/A
Environmental	86 B	% DER<TER	N/A		
CO_2 Emissions (t/year)	1.17	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		

Assessor Details	Mr. Carlos Val Escudero, Jostec, Tel: 01923518923, carlos@jostec.co.uk	Assessor ID	H664-0001
Client	Sterling Rose Ltd, 19686		

CALCULATION OF HEAT DEMAND 09 Jan 2014

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SAP 2012 WORKSHEET FOR Conversion (As Built)   (Version 9.92, January 2014)
CALCULATION OF HEAT DEMAND      09 Jan 2014
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1. Overall dwelling dimensions
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                                                          Area          Storey height              Volume
                                                          (m2)                (m)                  (m3)
Ground floor                                            54.0900 (1b)    x      2.7500 (2b)    =   148.7475 (1b) - (3b)
First floor                                             32.0700 (1c)    x      2.4500 (2c)    =    78.5715 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)          86.1600                                          (4)
Dwelling volume                                                      (3a)+(3b)+(3c)+(3d)+(3e)...(3n) =   227.3190 (5)


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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) =       0.1320 (8)
Pressure test                                                                                                            Yes
Measured/design AP50                                                                                                   3.5500
Infiltration rate                                                                                                      0.3095 (18)
Number of sides sheltered                                                                                                   2 (19)

Shelter factor                                                                   (20) =  1  -  [0.075 x (19)]  =       0.8500 (20)
Infiltration rate adjusted to include shelter factor                                      (21) = (18) x (20)  =       0.2631 (21)

                 Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
Wind speed     3.7000     3.5000     3.4000     3.2000     3.1000     2.8000     3.0000     2.7000     2.6000     2.8000     2.9000     3.2000 (22)
Wind factor    0.9250     0.8750     0.8500     0.8000     0.7750     0.7000     0.7500     0.6750     0.6500     0.7000     0.7250     0.8000 (22a)
Adj infilt rate
               0.2433     0.2302     0.2236     0.2104     0.2039     0.1841     0.1973     0.1776     0.1710     0.1841     0.1907     0.2104 (22b)
Effective ac   0.5296     0.5265     0.5250     0.5221     0.5208     0.5170     0.5195     0.5158     0.5146     0.5170     0.5182     0.5221 (25)


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3. Heat losses and heat loss parameter
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Element                                        Gross      Openings      NetArea      U-value        A x U       K-value        A x K
                                                m2          m2            m2          W/m2K          W/K        kJ/m2K         kJ/K
Entrance door                                                            1.9300       1.6000       3.0880                             (26)
Windows (Uw = 1.60)                                                      6.6000       1.5038       9.9248                             (27)
Rooflight (Uw = 1.60)                                                    7.1700       1.5038      10.7820                             (27a)
Floor                                                                   54.0900       0.1400       7.5726                             (28a)
External Wall                                  40.6500     8.5300      32.1200       0.1700       5.4604                             (29a)
External Roof 1                                53.3900     7.1700      46.2200       0.1200       5.5464                             (30)
External Roof 2                                 2.0800                  2.0800       0.1900       0.3952                             (30)
Total net area of external elements Aum(A, m2)                         150.2100                                                       (31)
Fabric heat loss, W/K = Sum (A x U)                                          (26)...(30) + (32) =   42.7694                          (33)
Party Wall                                                              88.7900       0.0000       0.0000                             (32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K                                                                   250.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)                                                           22.5315 (36)
Total fabric heat loss                                                                                  (33) + (36) =   65.3009 (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         39.7283    39.4947    39.3828    39.1687    39.0665    38.7794    38.9675    38.6902    38.6042    38.7794    38.8718    39.1687 (38)
Heat transfer coeff
             105.0292   104.7956   104.6837   104.4696   104.3674   104.0802   104.2684   103.9910   103.9051   104.0802   104.1727   104.4696 (39)
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CALCULATION OF HEAT DEMAND 09 Jan 2014

Average = Sum(39)m / 12 = 104.3594 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2190	1.2163	1.2150	1.2125	1.2113	1.2080	1.2102	1.2070	1.2060	1.2080	1.2091	1.2125	(40)
HLP (average)												1.2112	(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 2.5694 (42)
Average daily hot water use (litres/day) 95.2240 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.7463	100.9374	97.1284	93.3195	89.5105	85.7016	85.7016	89.5105	93.3195	97.1284	100.9374	104.7463	(44)
Energy conte	155.3358	135.8577	140.1930	122.2236	117.2765	101.2007	93.7773	107.6108	108.8960	126.9078	138.5298	150.4344	(45)
Energy content (annual)										Total = Sum(45)m =		1498.2436	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3004	20.3787	21.0289	18.3335	17.5915	15.1801	14.0666	16.1416	16.3344	19.0362	20.7795	22.5652	(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	1.8619	1.6817	1.8619	1.8018	1.8619	1.8018	1.8619	1.8619	1.8018	1.8619	1.8018	1.8619	(61)
Total heat required for water heating calculated for each month	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(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)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Output from w/h	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(64)
								Total per year (kWh/year) = Sum(64)m =				1520.1655	(64)
RHI water heating demand												1520	(64)
Heat gains from water heating, kWh/month	52.1146	45.5931	47.0796	41.0898	39.4599	34.0997	31.6464	36.2461	36.6584	42.6623	46.5116	50.4849	(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	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	52.9254	47.0078	38.2293	28.9421	21.6345	18.2648	19.7357	25.6533	34.4318	43.7190	51.0266	54.3963	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	346.0197	349.6103	340.5621	321.2995	296.9840	274.1309	258.8636	255.2730	264.3212	283.5837	307.8992	330.7524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	(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)	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	(71)
Water heating gains (Table 5)	70.0465	67.8469	63.2791	57.0692	53.0375	47.3607	42.5355	48.7178	50.9144	57.3418	64.5995	67.8561	(72)
Total internal gains	576.3662	571.8396	549.4451	514.6854	479.0307	447.1309	428.5094	437.0187	457.0420	492.0192	530.8999	560.3794	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4000	11.9531	0.6500	0.7000	0.7700	5.2766	(74)
Northeast	2.6000	12.9148	0.6500	0.7000	0.7700	10.5878	(75)
Northwest	2.6000	12.9148	0.6500	0.7000	0.7700	10.5878	(81)
South	5.1900	47.0242	0.6500	0.7000	1.0000	99.9407	(82)
Horizontal	1.9800	30.0000	0.6500	0.7000	1.0000	24.3243	(82)

Solar gains	150.7172	255.2899	417.9247	636.9887	775.7152	860.5941	811.8484	693.0834	531.4804	336.0763	191.1953	123.6929	(83)
Total gains	727.0833	827.1295	967.3698	1151.6741	1254.7459	1307.7250	1240.3578	1130.1021	988.5224	828.0954	722.0951	684.0722	(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	56.9683	57.0953	57.1563	57.2735	57.3295	57.4877	57.3840	57.5370	57.5846	57.4877	57.4367	57.2735	
alpha	4.7979	4.8064	4.8104	4.8182	4.8220	4.8325	4.8256	4.8358	4.8390	4.8325	4.8291	4.8182	
util living area	0.9886	0.9784	0.9398	0.8195	0.6114	0.3720	0.2352	0.2665	0.5602	0.8753	0.9741	0.9909	(86)
MIT	20.2010	20.3190	20.5532	20.7946	20.9143	20.9417	20.9436	20.9436	20.9296	20.7725	20.4511	20.1827	(87)
Th 2	19.9048	19.9070	19.9080	19.9100	19.9110	19.9136	19.9119	19.9144	19.9152	19.9136	19.9128	19.9100	(88)
util rest of house	0.9848	0.9713	0.9206	0.7717	0.5356	0.2871	0.1439	0.1669	0.4580	0.8263	0.9638	0.9877	(89)
MIT 2	18.8672	19.0382	19.3670	19.6788	19.8073	19.8306	19.8295	19.8323	19.8260	19.6662	19.2342	18.8452	(90)
Living area fraction									fLA = Living area / (4) =			0.3830	(91)

CALCULATION OF HEAT DEMAND 09 Jan 2014

MIT	19.3781	19.5287	19.8213	20.1062	20.2313	20.2562	20.2562	20.2579	20.2487	20.0899	19.7003	19.3575	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2281	19.3787	19.6713	19.9562	20.0813	20.1062	20.1062	20.1079	20.0987	19.9399	19.5503	19.2075	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9669	0.9156	0.7740	0.5479	0.3023	0.1602	0.1847	0.4759	0.8277	0.9594	0.9849	(94)
Useful gains	713.7099	799.7262	885.7141	891.3398	687.5194	395.2878	198.7357	208.7562	470.3942	685.4086	692.7454	673.7670	(95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1452.3511	1412.5133	1253.2009	1019.2234	707.7480	396.1490	198.7599	208.8045	477.8238	826.3911	1161.5544	1432.0141	(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	549.5490	411.7930	273.4102	92.0762	15.0501	0.0000	0.0000	0.0000	0.0000	104.8910	337.5424	564.1358	(98)
Space heating												2348.4478	(98)
RHI space heating demand												2348	(98)

FULL SAP CALCULATION PRINTOUT
Calculation Type: Conversion (As Built)

Design SAP
elmhurst energy

CALCULATION OF ENERGY RATINGS 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (As Built) (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	54.0900	(1b)	x	2.7500	(2b)	= 148.7475	(1b) - (3b)
First floor	32.0700	(1c)	x	2.4500	(2c)	= 78.5715	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1600						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	227.3190	(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) =	0.1320	(8)
Pressure test		Yes	
Measured/design AP50		3.5500	
Infiltration rate		0.3095	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2631	(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	0.3354	0.3288	0.3222	0.2894	0.2828	0.2499	0.2499	0.2433	0.2631	0.2828	0.2959	0.3091	(22b)
Effective ac	0.5562	0.5541	0.5519	0.5419	0.5400	0.5312	0.5312	0.5296	0.5346	0.5400	0.5438	0.5478	(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	
Entrance door			1.9300	1.6000	3.0880			(26)
Windows (Uw = 1.60)			6.6000	1.5038	9.9248			(27)
Rooflight (Uw = 1.60)			7.1700	1.5038	10.7820			(27a)
Floor			54.0900	0.1400	7.5726			(28a)
External Wall	40.6500	8.5300	32.1200	0.1700	5.4604			(29a)
External Roof 1	53.3900	7.1700	46.2200	0.1200	5.5464			(30)
External Roof 2	2.0800		2.0800	0.1900	0.3952			(30)
Total net area of external elements Aum(A, m2)			150.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7694			(33)
Party Wall			88.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	22.5315	(36)
Total fabric heat loss (33) + (36) =	65.3009	(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	41.7268	41.5629	41.4023	40.6481	40.5069	39.8500	39.8500	39.7283	40.1030	40.5069	40.7924	41.0909	(38)
Heat transfer coeff	107.0276	106.8638	106.7032	105.9489	105.8078	105.1508	105.1508	105.0292	105.4039	105.8078	106.0933	106.3918	(39)
Average = Sum(39)m / 12 =												105.9483	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2422	1.2403	1.2384	1.2297	1.2280	1.2204	1.2204	1.2190	1.2234	1.2280	1.2314	1.2348	(40)
HLP (average)												1.2297	(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	2.5694	(42)
Average daily hot water use (litres/day)	95.2240	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.7463	100.9374	97.1284	93.3195	89.5105	85.7016	85.7016	89.5105	93.3195	97.1284	100.9374	104.7463	(44)
Energy conte	155.3358	135.8577	140.1930	122.2236	117.2765	101.2007	93.7773	107.6108	108.8960	126.9078	138.5298	150.4344	(45)
Energy content (annual)										Total = Sum(45)m =		1498.2436	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3004	20.3787	21.0289	18.3335	17.5915	15.1801	14.0666	16.1416	16.3344	19.0362	20.7795	22.5652	(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	1.8619	1.6817	1.8619	1.8018	1.8619	1.8018	1.8619	1.8619	1.8018	1.8619	1.8018	1.8619	(61)
Total heat required for water heating calculated for each month													
	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(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)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Output from w/h													
	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(64)
								Total per year (kWh/year) = Sum(64)m =				1520.1655	(64)
Heat gains from water heating, kWh/month													
	52.1146	45.5931	47.0796	41.0898	39.4599	34.0997	31.6464	36.2461	36.6584	42.6623	46.5116	50.4849	(65)

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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	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.9254	47.0078	38.2293	28.9421	21.6345	18.2648	19.7357	25.6533	34.4318	43.7190	51.0266	54.3963	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	346.0197	349.6103	340.5621	321.2995	296.9840	274.1309	258.8636	255.2730	264.3212	283.5837	307.8992	330.7524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	(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)													
	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	(71)
Water heating gains (Table 5)													
	70.0465	67.8469	63.2791	57.0692	53.0375	47.3607	42.5355	48.7178	50.9144	57.3418	64.5995	67.8561	(72)
Total internal gains													
	576.3662	571.8396	549.4451	514.6854	479.0307	447.1309	428.5094	437.0187	457.0420	492.0192	530.8999	560.3794	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4000	10.6334	0.6500	0.7000	0.7700	4.6940	(74)
Northeast	2.6000	11.2829	0.6500	0.7000	0.7700	9.2500	(75)
Northwest	2.6000	11.2829	0.6500	0.7000	0.7700	9.2500	(81)
South	5.1900	42.0754	0.6500	0.7000	1.0000	89.4230	(82)
Horizontal	1.9800	26.0000	0.6500	0.7000	1.0000	21.0811	(82)

Solar gains	133.6980	255.6206	415.0679	609.4808	759.2135	784.6308	743.8091	629.2034	482.8980	300.9712	165.4292	110.8799	(83)
Total gains	710.0642	827.4602	964.5130	1124.1662	1238.2442	1231.7617	1172.3185	1066.2221	939.9400	792.9904	696.3291	671.2593	(84)

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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	55.9046	55.9903	56.0745	56.4737	56.5491	56.9024	56.9024	56.9683	56.7658	56.5491	56.3969	56.2387	
alpha	4.7270	4.7327	4.7383	4.7649	4.7699	4.7935	4.7935	4.7979	4.7844	4.7699	4.7598	4.7492	
util living area													
	0.9923	0.9835	0.9570	0.8760	0.7205	0.5323	0.3919	0.4475	0.7074	0.9310	0.9850	0.9940	(86)
MIT	20.0721	20.2135	20.4406	20.7036	20.8691	20.9294	20.9408	20.9386	20.8930	20.6513	20.3076	20.0411	(87)
Th 2	19.8864	19.8879	19.8894	19.8963	19.8976	19.9037	19.9037	19.9048	19.9014	19.8976	19.8950	19.8922	(88)
util rest of house													
	0.9898	0.9783	0.9436	0.8410	0.6564	0.4471	0.2957	0.3439	0.6189	0.9026	0.9792	0.9921	(89)
MIT 2	18.6656	18.8708	19.1945	19.5537	19.7500	19.8127	19.8200	19.8203	19.7831	19.4979	19.0144	18.6252	(90)
Living area fraction									fLA = Living area / (4) =			0.3830	(91)
MIT	19.2043	19.3850	19.6717	19.9941	20.1786	20.2404	20.2493	20.2486	20.2082	19.9397	19.5097	19.1675	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0543	19.2350	19.5217	19.8441	20.0286	20.0904	20.0993	20.0986	20.0582	19.7897	19.3597	19.0175	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9873	0.9743	0.9382	0.8391	0.6645	0.4620	0.3130	0.3625	0.6325	0.8992	0.9756	0.9900	(94)
Useful gains	701.0358	806.2104	904.8583	943.2654	822.8682	569.1040	366.9718	386.5142	594.4934	713.0254	679.3314	664.5267	(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													
	1579.1145	1531.8979	1389.4619	1159.5193	881.2289	577.3186	367.9499	388.4639	628.0190	972.3376	1300.6732	1576.4616	(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													
	653.2906	487.6621	360.5451	155.7028	43.4203	0.0000	0.0000	0.0000	0.0000	192.9283	447.3660	678.4796	(98)
Space heating												3019.3947	(98)
Space heating per m2											(98) / (4) =	35.0440	(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 %)	90.2000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3347.4442	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	653.2906	487.6621	360.5451	155.7028	43.4203	0.0000	0.0000	0.0000	0.0000	192.9283	447.3660	678.4796	(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)	724.2689	540.6453	399.7174	172.6195	48.1378	0.0000	0.0000	0.0000	0.0000	213.8894	495.9712	752.1946	(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	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(64)
Efficiency of water heater												86.6000	(216)
(217)m	89.4786	89.3826	89.1525	88.5676	87.5331	86.6000	86.6000	86.6000	86.6000	88.7236	89.3135	89.5178	(217)
Fuel for water heating, kWh/month	175.6819	153.8771	159.3391	140.0348	136.1065	118.9405	110.4378	126.4119	127.8266	145.1357	157.1226	170.1296	(219)
Water heating fuel used												1721.0443	(219)

Annual totals kWh/year		
Space heating fuel - main system	3347.4442	(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)	373.8714	(232)
Total delivered energy for all uses	5517.3599	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3347.4442	3.4800	116.4911	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1721.0443	3.4800	59.8923	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	373.8714	13.1900	49.3136	(250)
Additional standing charges			120.0000	(251)
Total energy cost			355.5895	(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] =	1.1387	(257)
SAP value		84.1156	
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	3347.4442	0.2160	723.0479	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1721.0443	0.2160	371.7456	(264)
Space and water heating			1094.7935	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	373.8714	0.5190	194.0392	(268)
Total kg/year			1327.7578	(272)
CO2 emissions per m2			15.4100	(273)
EI value			86.4349	
EI rating			86	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.25) / 0.9020 = 4.138, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.25) / 0.9020 = 0.2568, stars = 4
Water heating energy efficiency	3.48 / 0.8817 = 3.947, stars = 4
Water heating environmental impact	0.216 / 0.8817 = 0.2450, stars = 4

SAP 2012 WORKSHEET FOR Conversion (As Built) (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	54.0900	(1b)	x	2.7500 (2b)	=	148.7475	(1b) - (3b)
First floor	32.0700	(1c)	x	2.4500 (2c)	=	78.5715	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1600						(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	227.3190	(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) =	0.1320	(8)
Pressure test		Yes	
Measured/design AP50		3.5500	
Infiltration rate		0.3095	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2631	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000	(22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000	(22a)
Adj infilt rate	0.2433	0.2302	0.2236	0.2104	0.2039	0.1841	0.1973	0.1776	0.1710	0.1841	0.1907	0.2104	(22b)
Effective ac	0.5296	0.5265	0.5250	0.5221	0.5208	0.5170	0.5195	0.5158	0.5146	0.5170	0.5182	0.5221	(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	
Entrance door			1.9300	1.6000	3.0880			(26)
Windows (Uw = 1.60)			6.6000	1.5038	9.9248			(27)
Rooflight (Uw = 1.60)			7.1700	1.5038	10.7820			(27a)
Floor			54.0900	0.1400	7.5726			(28a)
External Wall	40.6500	8.5300	32.1200	0.1700	5.4604			(29a)
External Roof 1	53.3900	7.1700	46.2200	0.1200	5.5464			(30)
External Roof 2	2.0800		2.0800	0.1900	0.3952			(30)
Total net area of external elements Aum(A, m2)			150.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7694			(33)
Party Wall			88.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	22.5315	(36)
Total fabric heat loss (33) + (36) =	65.3009	(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	39.7283	39.4947	39.3828	39.1687	39.0665	38.7794	38.9675	38.6902	38.6042	38.7794	38.8718	39.1687	(38)
Heat transfer coeff	105.0292	104.7956	104.6837	104.4696	104.3674	104.0802	104.2684	103.9910	103.9051	104.0802	104.1727	104.4696	(39)
Average = Sum(39)m / 12 =												104.3594	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2190	1.2163	1.2150	1.2125	1.2113	1.2080	1.2102	1.2070	1.2060	1.2080	1.2091	1.2125	(40)
HLP (average)												1.2112	(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	2.5694	(42)
Average daily hot water use (litres/day)	95.2240	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.7463	100.9374	97.1284	93.3195	89.5105	85.7016	85.7016	89.5105	93.3195	97.1284	100.9374	104.7463	(44)
Energy conte	155.3358	135.8577	140.1930	122.2236	117.2765	101.2007	93.7773	107.6108	108.8960	126.9078	138.5298	150.4344	(45)
Energy content (annual)										Total = Sum(45)m =		1498.2436	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3004	20.3787	21.0289	18.3335	17.5915	15.1801	14.0666	16.1416	16.3344	19.0362	20.7795	22.5652	(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	1.8619	1.6817	1.8619	1.8018	1.8619	1.8018	1.8619	1.8619	1.8018	1.8619	1.8018	1.8619	(61)
Total heat required for water heating calculated for each month													
	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(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)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Output from w/h													
	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(64)
								Total per year (kWh/year) = Sum(64)m =				1520.1655	(64)
Heat gains from water heating, kWh/month													
	52.1146	45.5931	47.0796	41.0898	39.4599	34.0997	31.6464	36.2461	36.6584	42.6623	46.5116	50.4849	(65)

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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	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.9254	47.0078	38.2293	28.9421	21.6345	18.2648	19.7357	25.6533	34.4318	43.7190	51.0266	54.3963	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	346.0197	349.6103	340.5621	321.2995	296.9840	274.1309	258.8636	255.2730	264.3212	283.5837	307.8992	330.7524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	(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)													
	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	(71)
Water heating gains (Table 5)													
	70.0465	67.8469	63.2791	57.0692	53.0375	47.3607	42.5355	48.7178	50.9144	57.3418	64.5995	67.8561	(72)
Total internal gains													
	576.3662	571.8396	549.4451	514.6854	479.0307	447.1309	428.5094	437.0187	457.0420	492.0192	530.8999	560.3794	(73)

---

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4000	11.9531	0.6500	0.7000	0.7700	5.2766	(74)
Northeast	2.6000	12.9148	0.6500	0.7000	0.7700	10.5878	(75)
Northwest	2.6000	12.9148	0.6500	0.7000	0.7700	10.5878	(81)
South	5.1900	47.0242	0.6500	0.7000	1.0000	99.9407	(82)
Horizontal	1.9800	30.0000	0.6500	0.7000	1.0000	24.3243	(82)

Solar gains	150.7172	255.2899	417.9247	636.9887	775.7152	860.5941	811.8484	693.0834	531.4804	336.0763	191.1953	123.6929	(83)
Total gains	727.0833	827.1295	967.3698	1151.6741	1254.7459	1307.7250	1240.3578	1130.1021	988.5224	828.0954	722.0951	684.0722	(84)

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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	56.9683	57.0953	57.1563	57.2735	57.3295	57.4877	57.3840	57.5370	57.5846	57.4877	57.4367	57.2735	
alpha	4.7979	4.8064	4.8104	4.8182	4.8220	4.8325	4.8256	4.8358	4.8390	4.8325	4.8291	4.8182	
util living area													
	0.9886	0.9784	0.9398	0.8195	0.6114	0.3720	0.2352	0.2665	0.5602	0.8753	0.9741	0.9909	(86)
MIT	20.2010	20.3190	20.5532	20.7946	20.9143	20.9417	20.9436	20.9436	20.9296	20.7725	20.4511	20.1827	(87)
Th 2	19.9048	19.9070	19.9080	19.9100	19.9110	19.9136	19.9119	19.9144	19.9152	19.9136	19.9128	19.9100	(88)
util rest of house													
	0.9848	0.9713	0.9206	0.7717	0.5356	0.2871	0.1439	0.1669	0.4580	0.8263	0.9638	0.9877	(89)
MIT 2	18.8672	19.0382	19.3670	19.6788	19.8073	19.8306	19.8295	19.8323	19.8260	19.6662	19.2342	18.8452	(90)
Living area fraction									fLA = Living area / (4) =			0.3830	(91)
MIT	19.3781	19.5287	19.8213	20.1062	20.2313	20.2562	20.2562	20.2579	20.2487	20.0899	19.7003	19.3575	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2281	19.3787	19.6713	19.9562	20.0813	20.1062	20.1062	20.1079	20.0987	19.9399	19.5503	19.2075	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9669	0.9156	0.7740	0.5479	0.3023	0.1602	0.1847	0.4759	0.8277	0.9594	0.9849	(94)
Useful gains	713.7099	799.7262	885.7141	891.3398	687.5194	395.2878	198.7357	208.7562	470.3942	685.4086	692.7454	673.7670	(95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	1452.3511	1412.5133	1253.2009	1019.2234	707.7480	396.1490	198.7599	208.8045	477.8238	826.3911	1161.5544	1432.0141	(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													
	549.5490	411.7930	273.4102	92.0762	15.0501	0.0000	0.0000	0.0000	0.0000	104.8910	337.5424	564.1358	(98)
Space heating												2348.4478	(98)
Space heating per m2											(98) / (4) =	27.2568	(99)

8c. Space cooling requirement

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	2603.6006	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	549.5490	411.7930	273.4102	92.0762	15.0501	0.0000	0.0000	0.0000	0.0000	104.8910	337.5424	564.1358	(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)	609.2561	456.5332	303.1155	102.0800	16.6852	0.0000	0.0000	0.0000	0.0000	116.2872	374.2156	625.4277	(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	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(64)
Efficiency of water heater												86.6000	(216)
(217)m	89.3736	89.2708	88.9359	88.0981	86.9894	86.6000	86.6000	86.6000	86.6000	88.1799	89.1122	89.4099	(217)
Fuel for water heating, kWh/month	175.8882	154.0697	159.7272	140.7810	136.9573	118.9405	110.4378	126.4119	127.8266	146.0307	157.4775	170.3349	(219)
Water heating fuel used												1724.8835	(219)

Annual totals kWh/year		
Space heating fuel - main system	2603.6006	(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)	373.8714	(232)
Total delivered energy for all uses	4777.3555	(238)

10a. Fuel costs - using BEDF prices (477)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2603.6006	3.8700	100.7593	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1724.8835	3.8700	66.7530	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Energy for lighting	373.8714	18.9000	70.6617	(250)
Additional standing charges			93.0000	(251)
Total energy cost			345.3490	(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	2603.6006	0.2160	562.3777	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1724.8835	0.2160	372.5748	(264)
Space and water heating			934.9526	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	373.8714	0.5190	194.0392	(268)
Total kg/year			1167.9168	(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	2603.6006	1.2200	3176.3927	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1724.8835	1.2200	2104.3579	(264)
Space and water heating			5280.7507	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	373.8714	3.0700	1147.7851	(268)
Primary energy kWh/year			6658.7858	(272)
Primary energy kWh/m2/year			77.2840	(273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:	B 84
Current environmental impact rating:	B 86

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	-£ 28	-180 kg (15.4%)
U Solar photovoltaic panels	+ 10.2	-£ 347	-953 kg (96.6%)

	Typical annual savings		Energy efficiency	Environmental impact
Recommended measures				
Solar water heating	£28	2.09 kg/m²	B 85	B 88
Solar photovoltaic panels	£347	11.07 kg/m²	A 95	A 97
Total Savings	£375	13.16 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 477 TEST (30 Apr 2021)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£85	£94	-£9
Mains gas	£261	£224	£37
Space heating	£208	£208	£0
Water heating	£67	£39	£28
Lighting	£71	£71	£0
Generated (PV)	-£0	-£347	£347
Total cost of fuels	£346	-£29	£375
Total cost of uses	£346	-£29	£375
Delivered energy	55 kWh/m²	24 kWh/m²	32 kWh/m²
Carbon dioxide emissions	1.2 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	0 kg/m²	13 kg/m²
Primary energy	77 kWh/m²	0 kWh/m²	77 kWh/m²

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (As Built) (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	54.0900	(1b)	x	2.7500	(2b)	= 148.7475	(1b) - (3b)
First floor	32.0700	(1c)	x	2.4500	(2c)	= 78.5715	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1600						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	227.3190	(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) =	0.1320	(8)
Pressure test		Yes	
Measured/design AP50		3.5500	
Infiltration rate		0.3095	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2631	(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	0.3354	0.3288	0.3222	0.2894	0.2828	0.2499	0.2499	0.2433	0.2631	0.2828	0.2959	0.3091	(22b)
Effective ac	0.5562	0.5541	0.5519	0.5419	0.5400	0.5312	0.5312	0.5296	0.5346	0.5400	0.5438	0.5478	(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	
Entrance door			1.9300	1.6000	3.0880			(26)
Windows (Uw = 1.60)			6.6000	1.5038	9.9248			(27)
Rooflight (Uw = 1.60)			7.1700	1.5038	10.7820			(27a)
Floor			54.0900	0.1400	7.5726			(28a)
External Wall	40.6500	8.5300	32.1200	0.1700	5.4604			(29a)
External Roof 1	53.3900	7.1700	46.2200	0.1200	5.5464			(30)
External Roof 2	2.0800		2.0800	0.1900	0.3952			(30)
Total net area of external elements Aum(A, m2)			150.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7694			(33)
Party Wall			88.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	22.5315	(36)
Total fabric heat loss (33) + (36) =	65.3009	(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	41.7268	41.5629	41.4023	40.6481	40.5069	39.8500	39.8500	39.7283	40.1030	40.5069	40.7924	41.0909	(38)
Heat transfer coeff	107.0276	106.8638	106.7032	105.9489	105.8078	105.1508	105.1508	105.0292	105.4039	105.8078	106.0933	106.3918	(39)
Average = Sum(39)m / 12 =												105.9483	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2422	1.2403	1.2384	1.2297	1.2280	1.2204	1.2204	1.2190	1.2234	1.2280	1.2314	1.2348	(40)
HLP (average)												1.2297	(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	2.5694	(42)
Average daily hot water use (litres/day)	95.2240	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.7463	100.9374	97.1284	93.3195	89.5105	85.7016	85.7016	89.5105	93.3195	97.1284	100.9374	104.7463	(44)
Energy conte	155.3358	135.8577	140.1930	122.2236	117.2765	101.2007	93.7773	107.6108	108.8960	126.9078	138.5298	150.4344	(45)
Energy content (annual)										Total = Sum(45)m =		1498.2436	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3004	20.3787	21.0289	18.3335	17.5915	15.1801	14.0666	16.1416	16.3344	19.0362	20.7795	22.5652	(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	1.8619	1.6817	1.8619	1.8018	1.8619	1.8018	1.8619	1.8619	1.8018	1.8619	1.8018	1.8619	(61)
Total heat required for water heating calculated for each month													
	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(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	1.2105	(H8)
Utilisation factor	0.5623	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	95.2240	(H14)
Volume ratio Veff/V	0.7876	(H15)
Solar storage volume factor	0.9523	(H16)
Solar input	-853.8063	(H17)

Solar input	-24.7587	-41.3151	-70.3644	-94.3021	-116.5023	-114.5404	-113.0267	-98.7520	-77.3426	-52.8159	-29.3674	-20.7188	(63)
								Solar input (sum of months) = Sum(63)m =				-853.8063	(63)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Output from w/h													
	132.4390	96.2242	71.6904	29.7233	2.6360	0.0000	0.0000	10.7207	33.3553	75.9538	110.9643	131.5775	(64)
								Total per year (kWh/year) = Sum(64)m =				695.2845	(64)
Heat gains from water heating, kWh/month													
	52.1146	45.5931	47.0796	41.0898	39.4599	34.0997	31.6464	36.2461	36.6584	42.6623	46.5116	50.4849	(65)

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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	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.9254	47.0078	38.2293	28.9421	21.6345	18.2648	19.7357	25.6533	34.4318	43.7190	51.0266	54.3963	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	346.0197	349.6103	340.5621	321.2995	296.9840	274.1309	258.8636	255.2730	264.3212	283.5837	307.8992	330.7524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	(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)													
	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	(71)
Water heating gains (Table 5)													
	70.0465	67.8469	63.2791	57.0692	53.0375	47.3607	42.5355	48.7178	50.9144	57.3418	64.5995	67.8561	(72)
Total internal gains													
	576.3662	571.8396	549.4451	514.6854	479.0307	447.1309	428.5094	437.0187	457.0420	492.0192	530.8999	560.3794	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4000	10.6334	0.6500	0.7000	0.7700	4.6940	(74)
Northeast	2.6000	11.2829	0.6500	0.7000	0.7700	9.2500	(75)
Northwest	2.6000	11.2829	0.6500	0.7000	0.7700	9.2500	(81)
South	5.1900	42.0754	0.6500	0.7000	1.0000	89.4230	(82)
Horizontal	1.9800	26.0000	0.6500	0.7000	1.0000	21.0811	(82)

Solar gains	133.6980	255.6206	415.0679	609.4808	759.2135	784.6308	743.8091	629.2034	482.8980	300.9712	165.4292	110.8799	(83)
Total gains	710.0642	827.4602	964.5130	1124.1662	1238.2442	1231.7617	1172.3185	1066.2221	939.9400	792.9904	696.3291	671.2593	(84)

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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	55.9046	55.9903	56.0745	56.4737	56.5491	56.9024	56.9024	56.9683	56.7658	56.5491	56.3969	56.2387	
alpha	4.7270	4.7327	4.7383	4.7649	4.7699	4.7935	4.7935	4.7979	4.7844	4.7699	4.7598	4.7492	
util living area													
	0.9923	0.9835	0.9570	0.8760	0.7205	0.5323	0.3919	0.4475	0.7074	0.9310	0.9850	0.9940	(86)
MIT	20.0721	20.2135	20.4406	20.7036	20.8691	20.9294	20.9408	20.9386	20.8930	20.6513	20.3076	20.0411	(87)
Th 2	19.8864	19.8879	19.8894	19.8963	19.8976	19.9037	19.9037	19.9048	19.9014	19.8976	19.8950	19.8922	(88)
util rest of house													
	0.9898	0.9783	0.9436	0.8410	0.6564	0.4471	0.2957	0.3439	0.6189	0.9026	0.9792	0.9921	(89)
MIT 2	18.6656	18.8708	19.1945	19.5537	19.7500	19.8127	19.8200	19.8203	19.7831	19.4979	19.0144	18.6252	(90)
Living area fraction									fLA = Living area / (4) =			0.3830	(91)
MIT	19.2043	19.3850	19.6717	19.9941	20.1786	20.2404	20.2493	20.2486	20.2082	19.9397	19.5097	19.1675	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.0543	19.2350	19.5217	19.8441	20.0286	20.0904	20.0993	20.0986	20.0582	19.7897	19.3597	19.0175	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9873	0.9743	0.9382	0.8391	0.6645	0.4620	0.3130	0.3625	0.6325	0.8992	0.9756	0.9900	(94)
Useful gains	701.0358	806.2104	904.8583	943.2654	822.8682	569.1040	366.9718	386.5142	594.4934	713.0254	679.3314	664.5267	(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	1579.1145	1531.8979	1389.4619	1159.5193	881.2289	577.3186	367.9499	388.4639	628.0190	972.3376	1300.6732	1576.4616	(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	653.2906	487.6621	360.5451	155.7028	43.4203	0.0000	0.0000	0.0000	0.0000	192.9283	447.3660	678.4796	(98)
Space heating												3019.3947	(98)
Space heating per m2											(98) / (4) =	35.0440	(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 %)	90.2000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3347.4442	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	653.2906	487.6621	360.5451	155.7028	43.4203	0.0000	0.0000	0.0000	0.0000	192.9283	447.3660	678.4796	(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)	724.2689	540.6453	399.7174	172.6195	48.1378	0.0000	0.0000	0.0000	0.0000	213.8894	495.9712	752.1946	(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	132.4390	96.2242	71.6904	29.7233	2.6360	0.0000	0.0000	10.7207	33.3553	75.9538	110.9643	131.5775	(64)
Efficiency of water heater												86.6000	(216)
(217)m	89.5724	89.5863	89.5823	89.6029	89.9859	86.6000	86.6000	86.6000	86.6000	89.1531	89.4609	89.5950	(217)
Fuel for water heating, kWh/month	147.8570	107.4096	80.0274	33.1722	2.9293	0.0000	0.0000	12.3796	38.5165	85.1948	124.0366	146.8580	(219)
Water heating fuel used												778.3811	(219)

Annual totals kWh/year		
Space heating fuel - main system	3347.4442	(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)	373.8714	(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	2897.4573	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3347.4442	3.4800	116.4911	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	778.3811	3.4800	27.0877	(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	373.8714	13.1900	49.3136	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			101.5570	(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] =	0.3252	(257)
SAP value	95.4634	
SAP rating (Section 12)	95	(258)
SAP band	A	

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

	Energy	Emission factor	Emissions

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	3347.4442	0.2160	723.0479	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	778.3811	0.2160	168.1303	(264)
Space and water heating			891.1783	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	373.8714	0.5190	194.0392	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			253.6553	(272)
CO2 emissions per m2			2.9400	(273)
EI value			97.4085	
EI rating			97	(274)
EI band			A	

SAP 2012 WORKSHEET FOR Conversion (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 (m2)		Storey height (m)			Volume (m3)	
Ground floor	54.0900	(1b)	x	2.7500	(2b)	= 148.7475	(1b) - (3b)
First floor	32.0700	(1c)	x	2.4500	(2c)	= 78.5715	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.1600						(4)
Dwelling volume					(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	227.3190	(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) =	0.1320	(8)
Pressure test		Yes	
Measured/design AP50		3.5500	
Infiltration rate		0.3095	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2631	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	3.7000	3.5000	3.4000	3.2000	3.1000	2.8000	3.0000	2.7000	2.6000	2.8000	2.9000	3.2000	(22)
Wind factor	0.9250	0.8750	0.8500	0.8000	0.7750	0.7000	0.7500	0.6750	0.6500	0.7000	0.7250	0.8000	(22a)
Adj infilt rate	0.2433	0.2302	0.2236	0.2104	0.2039	0.1841	0.1973	0.1776	0.1710	0.1841	0.1907	0.2104	(22b)
Effective ac	0.5296	0.5265	0.5250	0.5221	0.5208	0.5170	0.5195	0.5158	0.5146	0.5170	0.5182	0.5221	(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	
Entrance door			1.9300	1.6000	3.0880			(26)
Windows (Uw = 1.60)			6.6000	1.5038	9.9248			(27)
Rooflight (Uw = 1.60)			7.1700	1.5038	10.7820			(27a)
Floor			54.0900	0.1400	7.5726			(28a)
External Wall	40.6500	8.5300	32.1200	0.1700	5.4604			(29a)
External Roof 1	53.3900	7.1700	46.2200	0.1200	5.5464			(30)
External Roof 2	2.0800		2.0800	0.1900	0.3952			(30)
Total net area of external elements Aum(A, m2)			150.2100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7694			(33)
Party Wall			88.7900	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Default value 0.150 * total exposed area)	22.5315	(36)
Total fabric heat loss (33) + (36) =	65.3009	(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	39.7283	39.4947	39.3828	39.1687	39.0665	38.7794	38.9675	38.6902	38.6042	38.7794	38.8718	39.1687	(38)
Heat transfer coeff	105.0292	104.7956	104.6837	104.4696	104.3674	104.0802	104.2684	103.9910	103.9051	104.0802	104.1727	104.4696	(39)
Average = Sum(39)m / 12 =												104.3594	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2190	1.2163	1.2150	1.2125	1.2113	1.2080	1.2102	1.2070	1.2060	1.2080	1.2091	1.2125	(40)
HLP (average)												1.2112	(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	2.5694	(42)
Average daily hot water use (litres/day)	95.2240	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.7463	100.9374	97.1284	93.3195	89.5105	85.7016	85.7016	89.5105	93.3195	97.1284	100.9374	104.7463	(44)
Energy conte	155.3358	135.8577	140.1930	122.2236	117.2765	101.2007	93.7773	107.6108	108.8960	126.9078	138.5298	150.4344	(45)
Energy content (annual)										Total = Sum(45)m =		1498.2436	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3004	20.3787	21.0289	18.3335	17.5915	15.1801	14.0666	16.1416	16.3344	19.0362	20.7795	22.5652	(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	1.8619	1.6817	1.8619	1.8018	1.8619	1.8018	1.8619	1.8619	1.8018	1.8619	1.8018	1.8619	(61)
Total heat required for water heating calculated for each month													
	157.1977	137.5394	142.0548	124.0254	119.1383	103.0025	95.6392	109.4727	110.6978	128.7697	140.3316	152.2963	(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	1148.2258	(H5)
Overshading factor	0.8000	(H6)
Solar energy available	1929.0194	(H7)
Adjustment factor for showers	1.0000	(H7a)
Solar-to-load ratio	1.2875	(H8)
Utilisation factor	0.5401	(H9)
Collector performance factor	0.8793	(H10)
Dedicated solar storage volume	75.0000	(H11)
Effective solar volume	75.0000	(H13)
Daily hot water demand	95.2240	(H14)
Volume ratio Veff/V	0.7876	(H15)
Solar storage volume factor	0.9523	(H16)
Solar input	-872.3166	(H17)

Solar input	-26.5791	-39.2444	-67.3275	-93.7191	-113.3600	-119.7530	-117.5447	-103.4946	-80.8978	-56.0669	-32.3095	-22.0199	(63)
								Solar input (sum of months) = Sum(63)m =				-872.3166	(63)
FGHRS	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
Output from w/h													
	130.6185	98.2949	74.7273	30.3063	5.7784	0.0000	0.0000	5.9781	29.8000	72.7028	108.0221	130.2764	(64)
								Total per year (kWh/year) = Sum(64)m =				686.5049	(64)
Heat gains from water heating, kWh/month													
	52.1146	45.5931	47.0796	41.0898	39.4599	34.0997	31.6464	36.2461	36.6584	42.6623	46.5116	50.4849	(65)

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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	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	154.1658	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	52.9254	47.0078	38.2293	28.9421	21.6345	18.2648	19.7357	25.6533	34.4318	43.7190	51.0266	54.3963	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	346.0197	349.6103	340.5621	321.2995	296.9840	274.1309	258.8636	255.2730	264.3212	283.5837	307.8992	330.7524	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	52.9860	(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)													
	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	-102.7772	(71)
Water heating gains (Table 5)													
	70.0465	67.8469	63.2791	57.0692	53.0375	47.3607	42.5355	48.7178	50.9144	57.3418	64.5995	67.8561	(72)
Total internal gains													
	576.3662	571.8396	549.4451	514.6854	479.0307	447.1309	428.5094	437.0187	457.0420	492.0192	530.8999	560.3794	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	1.4000	11.9531	0.6500	0.7000	0.7700	5.2766	(74)
Northeast	2.6000	12.9148	0.6500	0.7000	0.7700	10.5878	(75)
Northwest	2.6000	12.9148	0.6500	0.7000	0.7700	10.5878	(81)
South	5.1900	47.0242	0.6500	0.7000	1.0000	99.9407	(82)
Horizontal	1.9800	30.0000	0.6500	0.7000	1.0000	24.3243	(82)

Solar gains	150.7172	255.2899	417.9247	636.9887	775.7152	860.5941	811.8484	693.0834	531.4804	336.0763	191.1953	123.6929	(83)
Total gains	727.0833	827.1295	967.3698	1151.6741	1254.7459	1307.7250	1240.3578	1130.1021	988.5224	828.0954	722.0951	684.0722	(84)

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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	56.9683	57.0953	57.1563	57.2735	57.3295	57.4877	57.3840	57.5370	57.5846	57.4877	57.4367	57.2735	
alpha	4.7979	4.8064	4.8104	4.8182	4.8220	4.8325	4.8256	4.8358	4.8390	4.8325	4.8291	4.8182	
util living area													
	0.9886	0.9784	0.9398	0.8195	0.6114	0.3720	0.2352	0.2665	0.5602	0.8753	0.9741	0.9909	(86)
MIT	20.2010	20.3190	20.5532	20.7946	20.9143	20.9417	20.9436	20.9436	20.9296	20.7725	20.4511	20.1827	(87)
Th 2	19.9048	19.9070	19.9080	19.9100	19.9110	19.9136	19.9119	19.9144	19.9152	19.9136	19.9128	19.9100	(88)
util rest of house													
	0.9848	0.9713	0.9206	0.7717	0.5356	0.2871	0.1439	0.1669	0.4580	0.8263	0.9638	0.9877	(89)
MIT 2	18.8672	19.0382	19.3670	19.6788	19.8073	19.8306	19.8295	19.8323	19.8260	19.6662	19.2342	18.8452	(90)
Living area fraction									fLA = Living area / (4) =			0.3830	(91)
MIT	19.3781	19.5287	19.8213	20.1062	20.2313	20.2562	20.2562	20.2579	20.2487	20.0899	19.7003	19.3575	(92)
Temperature adjustment												-0.1500	
adjusted MIT	19.2281	19.3787	19.6713	19.9562	20.0813	20.1062	20.1062	20.1079	20.0987	19.9399	19.5503	19.2075	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9816	0.9669	0.9156	0.7740	0.5479	0.3023	0.1602	0.1847	0.4759	0.8277	0.9594	0.9849	(94)
Useful gains	713.7099	799.7262	885.7141	891.3398	687.5194	395.2878	198.7357	208.7562	470.3942	685.4086	692.7454	673.7670	(95)
Ext temp.	5.4000	5.9000	7.7000	10.2000	13.3000	16.3000	18.2000	18.1000	15.5000	12.0000	8.4000	5.5000	(96)
Heat loss rate W	1452.3511	1412.5133	1253.2009	1019.2234	707.7480	396.1490	198.7599	208.8045	477.8238	826.3911	1161.5544	1432.0141	(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	549.5490	411.7930	273.4102	92.0762	15.0501	0.0000	0.0000	0.0000	0.0000	104.8910	337.5424	564.1358	(98)
Space heating												2348.4478	(98)
Space heating per m2											(98) / (4) =	27.2568	(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 %)	90.2000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2603.6006	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	549.5490	411.7930	273.4102	92.0762	15.0501	0.0000	0.0000	0.0000	0.0000	104.8910	337.5424	564.1358	(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)	609.2561	456.5332	303.1155	102.0800	16.6852	0.0000	0.0000	0.0000	0.0000	116.2872	374.2156	625.4277	(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	130.6185	98.2949	74.7273	30.3063	5.7784	0.0000	0.0000	5.9781	29.8000	72.7028	108.0221	130.2764	(64)
Efficiency of water heater												86.6000	(216)
(217)m	89.4856	89.4832	89.4023	89.2809	89.1716	86.6000	86.6000	86.6000	86.6000	88.6907	89.3000	89.5020	(217)
Fuel for water heating, kWh/month	145.9659	109.8474	83.5855	33.9449	6.4801	0.0000	0.0000	6.9031	34.4111	81.9734	120.9654	145.5570	(219)
Water heating fuel used												769.6338	(219)

Annual totals kWh/year		
Space heating fuel - main system	2603.6006	(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)	373.8714	(232)
Energy saving/generation technologies (Appendices M ,N and Q)		
PV Unit 0 (0.80 * 2.50 * 1148 * 0.80) = -1837.1613	-1837.1613	(233)
Total delivered energy for all uses	2034.9444	(238)

10a. Fuel costs - using BEDF prices (477)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2603.6006	3.8700	100.7593	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	769.6338	3.8700	29.7848	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	373.8714	18.9000	70.6617	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1837.1613	18.9000	-347.2235	(252)
Total energy cost			-29.3926	(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	2603.6006	0.2160	562.3777	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	769.6338	0.2160	166.2409	(264)
Space and water heating			728.6186	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	373.8714	0.5190	194.0392	(268)
Energy saving/generation technologies				
PV Unit	-1837.1613	0.5190	-953.4867	(269)
Total kg/year			34.0461	(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	2603.6006	1.2200	3176.3927	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	769.6338	1.2200	938.9532	(264)
Space and water heating			4115.3460	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	373.8714	3.0700	1147.7851	(268)
Energy saving/generation technologies				
PV Unit	-1837.1613	3.0700	-5640.0853	(269)
Primary energy kWh/year			6.7958	(272)
Primary energy kWh/m2/year			0.0789	(273)

SUMMARY FOR INPUT DATA
Calculation Type: Conversion (As Built)

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Property Reference	19686 - Unit 3	**Issued on Date**	03/06/2021
Assessment Reference	As built	**Prop Type Ref**	
Property	3, IRIS MEWS, SUTTON, SM1 4GG		

SAP Rating	84 B	**DER**	N/A	**TER**	N/A
Environmental	86 B	**% DER<TER**	N/A		
CO_2 Emissions (t/year)	1.17	**DFEE**	N/A	**TFEE**	N/A
General Requirements Compliance	N/A	**% DFEE<TFEE**	N/A		

Assessor Details	Mr. Carlos Val Escudero, Jostec, Tel: 01923518923, carlos@jostec.co.uk	**Assessor ID**	H664-0001
Client	Sterling Rose Ltd, 19686		

SUMMARY FOR INPUT DATA FOR: Conversion (As Built)

Orientation	North
Property Tenure	Unknown
Transaction Type	New dwelling
Terrain Type	Suburban
1.0 Property Type	House, Mid-Terrace
2.0 Number of Storeys	2
3.0 Date Built	2020
4.0 Sheltered Sides	2
5.0 Sunlight/Shade	Average or unknown

6.0 Measurements

	Heat Loss Perimeter	Internal Floor Area	Average Storey Height
Ground Floor:	31.21 m	54.09 m²	2.75 m
1st Storey:	31.21 m	32.07 m²	2.45 m

7.0 Living Area	33.00	m²
8.0 Thermal Mass Parameter	Simple calculation - Medium	
Thermal Mass	250.00	kJ/m²K

9.0 External Walls

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Wall	Cavity Wall	0.17	40.65	32.12

9.1 Party Walls

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Party Wall	Filled Cavity with Edge Sealing		0.00	88.79

10.0 External Roofs

Description	Type	U-Value (W/m²K)	Gross Area (m²)	Nett Area (m²)
External Roof 1	External Slope Roof	0.12	53.39	46.22
External Roof 2	External Flat Roof	0.19	2.08	2.08

11.0 Heat Loss Floors

Description	Type	Construction	U-Value (W/m²K)	Area (m²)
Floor	Ground Floor - Solid		0.14	54.09

12.0 Opening Types

SUMMARY FOR INPUT DATA
Calculation Type: Conversion (As Built)

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Description	Data Source	Type	Glazing	Glazing Gap	Argon Filled	G-value	Frame Type	Frame Factor	U Value (W/m²K)
Entrance door	Manufacturer	Solid Door							1.60
Windows	Manufacturer	Window	Double Low-E Soft 0.05			0.65		0.70	1.60
Rooflight	Manufacturer	Roof Window	Double Low-E Soft 0.05			0.65		0.70	1.60

13.0 Openings

Name	Opening Type	Location	Orientation	Curtain Type	Overhang Ratio	Wide Overhang	Width (m)	Height (m)	Count	Area (m²)	Curtain Closed
Entrance	Solid Door	[1] External Wall	North							1.93	
South Rooflights	Roof Window	[1] External Roof 1	South	None						5.19	
Rooflight	Roof Window	[1] External Roof 1	Horizontal	None						1.98	
NE Windows	Window	[1] External Wall	North East	None	0.00					2.60	
North window	Window	[1] External Wall	North	None	0.00					1.40	
NW windows	Window	[1] External Wall	North West	None	0.00					2.60	

14.0 Conservatory	None	
15.0 Draught Proofing	100	%
16.0 Draught Lobby	No	
17.0 Thermal Bridging	Default	
Y-value	0.150	W/m²K
18.0 Pressure Testing	Yes	
Designed AP_{50}	15.00	m³/(h.m²) @ 50 Pa
Property Tested ?	Yes	
As Built AP_{50}	3.55	m³/(h.m²) @ 50 Pa

19.0 Mechanical Ventilation

Summer Overheating

Windows open in hot weather	Windows half open
Cross ventilation possible	Yes
Night Ventilation	Yes
Air change rate	4.00

Mechanical Ventilation

Mechanical Ventilation System Present	No

20.0 Fans, Open Fireplaces, Flues

	MHS	SHS	Other	Total
Number of Chimneys	0		0	0
Number of open flues	0		0	0
Number of intermittent fans				3
Number of passive vents				0
Number of flueless gas fires				0

21.0 Fixed Cooling System	No	

22.0 Lighting

Internal

Total number of light fittings	7	
Total number of L.E.L. fittings	7	
Percentage of L.E.L. fittings	100.00	%

External

External lights fitted	Yes

Light and motion sensor	Yes	
23.0 Electricity Tariff	Standard	
24.0 Main Heating 1	Database	
Percentage of Heat	100	%
Database Ref. No.	16980	
Fuel Type	Mains gas	
Main Heating	BGW	
SAP Code	104	
In Winter	90.2	
In Summer	86.6	
Controls	CBI Time and temperature zone control	
PCDF Controls	0	
Delayed Start Stat	Yes	
Sap Code	2110	
Flue Type	Balanced	
Fan Assisted Flue	Yes	
Is MHS Pumped	Pump in heated space	
Heat Emitter	Radiators and Underfloor	
Underfloor Heating	Yes - Pipes in thin screed	
Flow Temperature	Normal (> 45°C)	
Combi boiler type	Standard Combi	
Combi keep hot type	None	
25.0 Main Heating 2	None	

Community Heating	None
28.0 Water Heating	HWP From main heating 1
Water Heating	Main Heating 1
Flue Gas Heat Recovery System	Yes
Waste Water Heat Recovery Instantaneous System 1	No
Waste Water Heat Recovery Instantaneous System 2	No
Waste Water Heat Recovery Storage System	No
Solar Panel	No
Water use <= 125 litres/person/day	Yes
SAP Code	901
28.1 Flue Gas Heat Recovery System	
29.0 Hot Water Cylinder	None

Recommendations

Lower cost measures

None

Further measures to achieve even higher standards

SUMMARY FOR INPUT DATA
Calculation Type: Conversion (As Built)

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	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar water heating	£4,000 - £6,000	£28	B 85	

	Typical Cost	Typical savings per year	Ratings after improvement	
			SAP rating	Environmental Impact
Solar photovoltaic panels, 2.5 kWp	£3,500 - £5,500	£347	A 95	