

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

Property Reference	LAB-11-21-01	Issued on Date	12/06/2024
Assessment Reference	LAB-11-21-01-AB	Prop Type Ref	
Property	The Kiln, Lynch Court, Lynch Court, EARDISLAND, HR6 9AR		

SAP Rating	61 D	DER	N/A	TER	N/A
Environmental	72 C	% DER<TER	N/A		
CO <sub>2</sub> Emissions (t/year)	8.37	DFEE	N/A	TTEE	N/A
General Requirements Compliance	N/A	% DFEE<TTEE	N/A		

Assessor Details	Mr. Peter Loveday, Peter Loveday, Tel: 01885 488418, sales@energysurveysgb.co.uk	Assessor ID	L623-0001
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Client	
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### CALCULATION OF HEAT DEMAND 09 Jan 2014

SAP 2012 WORKSHEET FOR Conversion (As Built) (Version 9.92, January 2014)  
 CALCULATION OF HEAT DEMAND 09 Jan 2014

#### 1. Overall dwelling dimensions

	Area (m <sup>2</sup> )	Storey height (m)	Volume (m <sup>3</sup> )
Ground floor	161.3200 (1b)	x 2.3500 (2b)	= 379.1020 (1b) - (3b)
First floor	150.6300 (1c)	x 2.7200 (2c)	= 409.7136 (1c) - (3c)
Second floor	76.6000 (1d)	x 3.8900 (2d)	= 297.9740 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	388.5500		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1086.7896 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m <sup>3</sup> 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				5 * 10 =	50.0000 (7a)								
Number of passive vents				0 * 10 =	0.0000 (7b)								
Number of flueless gas fires				0 * 40 =	0.0000 (7c)								
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				50.0000 / (5) =	0.0460 (8)								
Pressure test				No									
Measured/design AP50				15.0000									
Infiltration rate				0.7960	(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) =		0.7363 (21)								
Wind speed	Jan 4.2000	Feb 4.1000	Mar 4.0000	Apr 3.5000	May 3.5000	Jun 3.1000	Jul 3.1000	Aug 2.9000	Sep 3.1000	Oct 3.3000	Nov 3.4000	Dec 3.6000	(22)
Wind factor	1.0500	1.0250	1.0000	0.8750	0.8750	0.7750	0.7750	0.7250	0.7750	0.8250	0.8500	0.9000	(22a)
Adj infiltr rate	0.7731	0.7547	0.7363	0.6443	0.6443	0.5706	0.5706	0.5338	0.5706	0.6075	0.6259	0.6627	(22b)
Effective ac	0.7989	0.7848	0.7711	0.7075	0.7075	0.6628	0.6628	0.6425	0.6628	0.6845	0.6959	0.7196	(25)

#### 3. Heat losses and heat loss parameter

Element	Gross m <sup>2</sup>	Openings m <sup>2</sup>	NetArea m <sup>2</sup>	U-value W/m <sup>2</sup> K	A x U W/K	K-value kJ/m <sup>2</sup> K	A x K kJ/K					
Windows (Uw = 1.60)			40.2300	1.5038	60.4962		(27)					
Glazed doors			2.4300	1.6000	3.8880		(26a)					
Solid doors			4.3900	1.6000	7.0240		(26)					
Velux (Uw = 1.40)			1.9600	1.3258	2.5985		(27a)					
Ground floor			161.3200	0.2100	33.8772		(28a)					
Stone walls	299.4900	37.5600	261.9300	0.3200	83.8176		(29a)					
Brick walls	108.5300	9.4900	99.0400	0.3100	30.7024		(29a)					
Sloping ceilings	224.0700	1.9600	222.1100	0.1700	37.7587		(30)					
Total net area of external elements Aum(A, m <sup>2</sup> )			793.4100				(31)					
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	260.1626	(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m <sup>2</sup> K							100.0000 (35)					
Thermal bridges (Default value 0.150 * total exposed area)							119.0115 (36)					
Total fabric heat loss						(33) + (36) =	379.1741 (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

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(38)m	286.5031	281.4600	276.5383	253.7528	253.7528	237.7119	237.7119	230.4205	237.7119	245.4893	249.5603	258.0669	(38)
Heat transfer coeff	665.6773	660.6341	655.7124	632.9269	632.9269	616.8860	616.8860	609.5946	616.8860	624.6634	628.7344	637.2410	(39)
Average = Sum(39)m / 12 =												633.2308	(39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.7132	1.7003	1.6876	1.6289	1.6289	1.5877	1.5877	1.5689	1.5877	1.6077	1.6182	1.6400	(40)
HLP (average)												1.6297	(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													3.2470	(42)
Average daily hot water use (litres/day)													111.3173	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Daily hot water use	122.4491	117.9964	113.5437	109.0910	104.6383	100.1856	100.1856	104.6383	109.0910	113.5437	117.9964	122.4491	(44)	
Energy conte	181.5884	158.8184	163.8863	142.8801	137.0968	118.3042	109.6262	125.7977	127.3001	148.3560	161.9421	175.8587	(45)	
Energy content (annual)													Total = Sum(45)m =	1751.4549 (45)
Distribution loss (46)m = 0.15 x (45)m	27.2383	23.8228	24.5830	21.4320	20.5645	17.7456	16.4439	18.8696	19.0950	22.2534	24.2913	26.3788	(46)	
Water storage loss:														
Store volume													300.0000	(47)
b) If manufacturer declared loss factor is not known :														
Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0115	(51)
Volume factor from Table 2a													0.7368	(52)
Temperature factor from Table 2b													0.5400	(53)
Enter (49) or (54) in (55)													1.3784	(55)
Total storage loss	42.7290	38.5939	42.7290	41.3506	42.7290	41.3506	42.7290	42.7290	41.3506	42.7290	41.3506	42.7290	(56)	
If cylinder contains dedicated solar storage	42.7290	38.5939	42.7290	41.3506	42.7290	41.3506	42.7290	42.7290	41.3506	42.7290	41.3506	42.7290	(57)	
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month	247.5798	218.4235	229.8777	206.7427	203.0882	182.1668	175.6176	191.7890	191.1627	214.3473	225.8048	241.8500	(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	247.5798	218.4235	229.8777	206.7427	203.0882	182.1668	175.6176	191.7890	191.1627	214.3473	225.8048	241.8500	(64)	
Total per year (kWh/year) = Sum(64)m =													2528.4501 (64)	
RHI water heating demand													2528 (64)	
Heat gains from water heating, kWh/month	113.1712	100.4912	107.2853	98.5977	98.3778	90.4262	89.2438	94.6208	93.4174	102.1215	104.9359	111.2661	(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	194.8227	194.8227	194.8227	194.8227	194.8227	194.8227	194.8227	194.8227	194.8227	194.8227	194.8227	194.8227	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	166.1019	147.5303	119.9797	90.8323	67.8982	57.3225	61.9390	80.5107	108.0613	137.2086	160.1427	170.7184	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	785.9258	794.0812	773.5298	729.7781	674.5495	622.6424	587.9653	579.8098	600.3613	644.1129	699.3416	751.2486	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	57.7293	57.7293	57.7293	57.7293	57.7293	57.7293	57.7293	57.7293	57.7293	57.7293	57.7293	57.7293	(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)	-129.8818	-129.8818	-129.8818	-129.8818	-129.8818	-129.8818	-129.8818	-129.8818	-129.8818	-129.8818	-129.8818	-129.8818	(71)
Water heating gains (Table 5)	152.1119	149.5405	144.2007	136.9413	132.2282	125.5920	119.9514	127.1785	129.7464	137.2600	145.7442	149.5512	(72)
Total internal gains	1229.8098	1216.8222	1163.3803	1083.2219	1000.3462	931.2272	895.5259	913.1693	963.8391	1044.2518	1130.8987	1197.1885	(73)

#### 6. Solar gains

[Jan]	Area	Solar flux	g	FF	Access	Gains							
	m <sup>2</sup>	Table 6a	Specific data	Specific data	factor	W							
		W/m <sup>2</sup>	or Table 6b	or Table 6c	Table 6d								
North	16.1600	12.4710	0.7600	0.7000	0.7700	74.2996 (74)							
East	6.3600	23.1826	0.7600	0.7000	0.7700	54.3581 (76)							
South	13.1600	53.6348	0.7600	0.7000	0.7700	260.2241 (78)							
West	4.5500	23.1826	0.7600	0.7000	0.7700	38.8883 (80)							
North	1.5300	17.8109	0.7600	0.7000	1.0000	13.0476 (82)							
West	0.4300	31.0970	0.7600	0.7000	1.0000	6.4024 (82)							
Solar gains	447.2200	698.2457	1039.7109	1400.9319	1618.1203	1741.9199	1616.5310	1432.6324	1171.7594	804.6451	521.9547	363.9579	(83)
Total gains	1677.0298	1915.0678	2203.0912	2484.1538	2618.4664	2673.1471	2512.0569	2345.8016	2135.5985	1848.8969	1652.8534	1561.1464	(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	16.2136	16.3374	16.4600	17.0526	17.0526	17.4960	17.4960	17.7053	17.4960	17.2782	17.1663	16.9372		
alpha	2.0809	2.0892	2.0973	2.1368	2.1368	2.1664	2.1664	2.1804	2.1664	2.1519	2.1444	2.1291		

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### CALCULATION OF HEAT DEMAND 09 Jan 2014

util living area	0.9830	0.9768	0.9629	0.9354	0.8895	0.8001	0.7248	0.7510	0.8768	0.9512	0.9768	0.9856 (86)
MIT	18.1783	18.3528	18.7638	19.3348	19.8605	20.3535	20.5723	20.5453	20.1445	19.4658	18.7801	18.1911 (87)
Th 2	19.5314	19.5407	19.5497	19.5922	19.5922	19.6224	19.6224	19.6362	19.6224	19.6077	19.6000	19.5841 (88)
util rest of house												
MIT 2	0.9797	0.9723	0.9550	0.9198	0.8567	0.7266	0.6013	0.6355	0.8287	0.9369	0.9715	0.9829 (89)
Living area fraction	15.8325	16.0888	16.6875	17.5301	18.2770	18.9639	19.2337	19.2184	18.6996	17.7343	16.7374	15.8729 (90)
MIT	16.2949	16.5351	17.0968	17.8859	18.5892	19.2378	19.4976	19.4800	18.9844	18.0757	17.1401	16.3300 (92)
Temperature adjustment												0.0000
adjusted MIT	16.2949	16.5351	17.0968	17.8859	18.5892	19.2378	19.4976	19.4800	18.9844	18.0757	17.1401	16.3300 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9681	0.9576	0.9347	0.8925	0.8245	0.6998	0.5870	0.6182	0.7975	0.9130	0.9569	0.9729 (94)
Useful gains	1623.4673	1833.8686	2059.2314	2217.1942	2158.8402	1870.7091	1474.5168	1450.1631	1703.0437	1688.1313	1581.5935	1518.8753 (95)
Ext temp.	4.5000	5.0000	6.7000	9.1000	11.9000	14.7000	16.4000	16.3000	14.0000	10.6000	7.2000	4.3000 (96)
Heat loss rate W												
Month fracti	7851.6158	7620.4726	6817.2997	5560.8404	4233.7873	2799.3304	1910.8826	1938.4939	3074.8235	4669.7685	6249.6988	7665.9818 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	4633.7425	3888.5979	3540.0029	2407.4252	1543.7606	0.0000	0.0000	0.0000	0.0000	2218.3380	3361.0358	4573.4473 (98)
RHI space heating demand												26166.3502 (98)
												26166 (98)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

### 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	161.3200 (1b)	x 2.3500 (2b)	= 379.1020 (1b) - (3b)
First floor	150.6300 (1c)	x 2.7200 (2c)	= 409.7136 (1c) - (3c)
Second floor	76.6000 (1d)	x 3.8900 (2d)	= 297.9740 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	388.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1086.7896 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.0460 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.7960 (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) =	0.7363 (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	0.9388	0.9204	0.9020	0.8099	0.7915	0.6995	0.6995	0.6811	0.7363	0.7915	0.8283	0.8652 (22b)
Effective ac	0.9407	0.9236	0.9068	0.8280	0.8133	0.7446	0.7446	0.7319	0.7711	0.8133	0.8431	0.8743 (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
Windows (Uw = 1.60)			40.2300	1.5038	60.4962		(27)
Glazed doors			2.4300	1.6000	3.8880		(26a)
Solid doors			4.3900	1.6000	7.0240		(26)
Velux (Uw = 1.40)			1.9600	1.3258	2.5985		(27a)
Ground floor			161.3200	0.2100	33.8772		(28a)
Stone walls	299.4900	37.5600	261.9300	0.3200	83.8176		(29a)
Brick walls	108.5300	9.4900	99.0400	0.3100	30.7024		(29a)
Sloping ceilings	224.0700	1.9600	222.1100	0.1700	37.7587		(30)
Total net area of external elements Aum(A, m2)			793.4100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) =	260.1626	(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							119.0115 (36)
Total fabric heat loss						(33) + (36) =	379.1741 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	337.3603	331.2234	325.2081	296.9541	291.6678	267.0595	267.0595	262.5024	276.5383	291.6678	302.3618	313.5419 (38)
Heat transfer coeff	716.5344	710.3976	704.3822	676.1282	670.8420	646.2337	646.2337	641.6766	655.7124	670.8420	681.5360	692.7160 (39)
Average = Sum(39)m / 12 =												676.1029 (39)
HLP	1.8441	1.8283	1.8128	1.7401	1.7265	1.6632	1.6632	1.6515	1.6876	1.7265	1.7540	1.7828 (40)
HLP (average)												1.7401 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.2470 (42)
Average daily hot water use (litres/day)												111.3173 (43)
Daily hot water use	122.4491	117.9964	113.5437	109.0910	104.6383	100.1856	100.1856	104.6383	109.0910	113.5437	117.9964	122.4491 (44)
Energy conte	181.5884	158.8184	163.8863	142.8801	137.0968	118.3042	109.6262	125.7977	127.3001	148.3560	161.9421	175.8587 (45)
Energy content (annual)												Total = Sum(45)m = 1751.4549 (45)
Distribution loss (46)m = 0.15 x (45)m	27.2383	23.8228	24.5830	21.4320	20.5645	17.7456	16.4439	18.8696	19.0950	22.2534	24.2913	26.3788 (46)



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### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Space heating 28737.8159 (98)  
 Space heating per m2 (98) / (4) = 73.9617 (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 %) 89.9000 (206)  
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)  
 Space heating requirement 31966.4248 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	5072.9591	4216.1646	3909.5597	2692.6964	1740.5860	0.0000	0.0000	0.0000	0.0000	2410.7736	3696.4114	4998.6652	(98)
Space heating efficiency (main heating system 1)	89.9000	89.9000	89.9000	89.9000	89.9000	0.0000	0.0000	0.0000	0.0000	89.9000	89.9000	89.9000	(210)
Space heating fuel (main heating system)	5642.8911	4689.8383	4348.7872	2995.2129	1936.1357	0.0000	0.0000	0.0000	0.0000	2681.6169	4111.6923	5560.2505	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	247.5798	218.4235	229.8777	206.7427	203.0882	182.1668	175.6176	191.7890	191.1627	214.3473	225.8048	241.8500	(64)
Efficiency of water heater (217)m	89.3384	89.3057	89.2305	89.0422	88.6486	79.2000	79.2000	79.2000	79.2000	88.9191	89.2062	89.3430	(217)
Fuel for water heating, kWh/month	277.1259	244.5795	257.6223	232.1850	229.0935	230.0086	221.7393	242.1579	241.3670	241.0588	253.1268	270.6985	(219)
Water heating fuel used												2940.7632	(219)
Annual totals kWh/year													
Space heating fuel - main system													31966.4248 (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) 1173.3647 (232)  
 Total delivered energy for all uses 36155.5527 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	31966.4248	7.6000	2429.4483	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2940.7632	7.6000	223.4980	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	1173.3647	13.1900	154.7668	(250)
Additional standing charges			70.0000	(251)
Total energy cost			2887.6056	(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] = 2.7974 (257)  
 SAP value 60.9769  
 SAP rating (Section 12) 61 (258)  
 SAP band D

#### 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	31966.4248	0.2410	7703.9084	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2940.7632	0.2410	708.7239	(264)
Space and water heating			8412.6323	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	1173.3647	0.5190	608.9763	(268)
Total kg/year			9060.5336	(272)
CO2 emissions per m2			23.3200	(273)
EI value			71.9960	
EI rating			72	(274)
EI band			C	

#### Calculation of stars for heating and DHW

Main heating energy efficiency  $7.60 \times (1 + 0.29 \times 0.25) / 0.8990 = 9.067$ , stars = 2  
 Main heating environmental impact  $0.241 \times (1 + 0.29 \times 0.25) / 0.8990 = 0.2875$ , stars = 4

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

### CALCULATION OF ENERGY RATINGS 09 Jan 2014

Water heating energy efficiency  
Water heating environmental impact

$7.60 / 0.8582 = 8.856$ , stars = 2  
 $0.241 / 0.8582 = 0.2808$ , stars = 4

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

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

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	161.3200 (1b)	x 2.3500 (2b)	= 379.1020 (1b) - (3b)
First floor	150.6300 (1c)	x 2.7200 (2c)	= 409.7136 (1c) - (3c)
Second floor	76.6000 (1d)	x 3.8900 (2d)	= 297.9740 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	388.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1086.7896 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.0460 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.7960 (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) =		0.7363 (21)

  

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.1000	4.0000	3.5000	3.5000	3.1000	3.1000	2.9000	3.1000	3.3000	3.4000	3.6000 (22)
Wind factor	1.0500	1.0250	1.0000	0.8750	0.8750	0.7750	0.7750	0.7250	0.7750	0.8250	0.8500	0.9000 (22a)
Adj infiltr rate	0.7731	0.7547	0.7363	0.6443	0.6443	0.5706	0.5706	0.5338	0.5706	0.6075	0.6259	0.6627 (22b)
Effective ac	0.7989	0.7848	0.7711	0.7075	0.7075	0.6628	0.6628	0.6425	0.6628	0.6845	0.6959	0.7196 (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
Windows (Uw = 1.60)			40.2300	1.5038	60.4962		(27)
Glazed doors			2.4300	1.6000	3.8880		(26a)
Solid doors			4.3900	1.6000	7.0240		(26)
Velux (Uw = 1.40)			1.9600	1.3258	2.5985		(27a)
Ground floor			161.3200	0.2100	33.8772		(28a)
Stone walls	299.4900	37.5600	261.9300	0.3200	83.8176		(29a)
Brick walls	108.5300	9.4900	99.0400	0.3100	30.7024		(29a)
Sloping ceilings	224.0700	1.9600	222.1100	0.1700	37.7587		(30)
Total net area of external elements Aum(A, m2)			793.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	260.1626		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							119.0115 (36)
Total fabric heat loss						(33) + (36) =	379.1741 (37)

  

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	286.5031	281.4600	276.5383	253.7528	253.7528	237.7119	237.7119	230.4205	237.7119	245.4893	249.5603	258.0669 (38)
Heat transfer coeff	665.6773	660.6341	655.7124	632.9269	632.9269	616.8860	616.8860	609.5946	616.8860	624.6634	628.7344	637.2410 (39)
Average = Sum(39)m / 12 =												633.2308 (39)

  

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.7132	1.7003	1.6876	1.6289	1.6289	1.5877	1.5877	1.5689	1.5877	1.6077	1.6182	1.6400 (40)
HLP (average)												1.6297 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.2470 (42)
Average daily hot water use (litres/day)												111.3173 (43)
Daily hot water use	122.4491	117.9964	113.5437	109.0910	104.6383	100.1856	100.1856	104.6383	109.0910	113.5437	117.9964	122.4491 (44)
Energy conte	181.5884	158.8184	163.8863	142.8801	137.0968	118.3042	109.6262	125.7977	127.3001	148.3560	161.9421	175.8587 (45)
Energy content (annual)												Total = Sum(45)m = 1751.4549 (45)
Distribution loss (46)m = 0.15 x (45)m	27.2383	23.8228	24.5830	21.4320	20.5645	17.7456	16.4439	18.8696	19.0950	22.2534	24.2913	26.3788 (46)





# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

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

Space heating 26166.3502 (98)  
 Space heating per m2 (98) / (4) = 67.3436 (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 %) 89.9000 (206)  
 Efficiency of secondary/supplementary heating system, % 0.0000 (208)  
 Space heating requirement 29106.0625 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	4633.7425	3888.5979	3540.0029	2407.4252	1543.7606	0.0000	0.0000	0.0000	0.0000	2218.3380	3361.0358	4573.4473	(98)
Space heating efficiency (main heating system 1)	89.9000	89.9000	89.9000	89.9000	89.9000	0.0000	0.0000	0.0000	0.0000	89.9000	89.9000	89.9000	(210)
Space heating fuel (main heating system)	5154.3298	4325.4704	3937.7118	2677.8924	1717.1975	0.0000	0.0000	0.0000	0.0000	2467.5618	3738.6383	5087.2606	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	247.5798	218.4235	229.8777	206.7427	203.0882	182.1668	175.6176	191.7890	191.1627	214.3473	225.8048	241.8500	(64)
Efficiency of water heater (217)m	89.2882	89.2587	89.1654	88.9496	88.5098	79.2000	79.2000	79.2000	79.2000	88.8424	89.1418	89.2941	(217)
Fuel for water heating, kWh/month	277.2817	244.7084	257.8103	232.4268	229.4528	230.0086	221.7393	242.1579	241.3670	241.2669	253.3095	270.8466	(219)
Water heating fuel used												2942.3759	(219)
Annual totals kWh/year													
Space heating fuel - main system												29106.0625	(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) 1173.3647 (232)  
 Total delivered energy for all uses 33296.8031 (238)

10a. Fuel costs - using BEDF prices (548)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	29106.0625	9.4000	2735.9699	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2942.3759	9.4000	276.5833	(247)
Pumps and fans for heating	75.0000	28.6600	21.4950	(249)
Energy for lighting	1173.3647	28.6600	336.2863	(250)
Additional standing charges			70.0000	(251)
Total energy cost			3440.3345	(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	29106.0625	0.2410	7014.5611	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2942.3759	0.2410	709.1126	(264)
Space and water heating			7723.6737	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	1173.3647	0.5190	608.9763	(268)
Total kg/year			8371.5749	(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	29106.0625	1.0900	31725.6082	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2942.3759	1.0900	3207.1897	(264)
Space and water heating			34932.7979	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	1173.3647	3.0700	3602.2296	(268)
Primary energy kWh/year			38765.2775	(272)
Primary energy kWh/m2/year			99.7691	(273)

SAP 2012 EPC IMPROVEMENTS

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

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

Current energy efficiency rating: D 61  
 Current environmental impact rating: C 72

(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	+ 1.3	-£ 115	-306 kg (3.7%)
U Solar photovoltaic panels	+ 3.1	-£ 525	-950 kg (11.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£115	0.79 kg/m <sup>2</sup>	D 62 C 73
Solar photovoltaic panels	£525	2.45 kg/m <sup>2</sup>	D 65 C 76
<b>Total Savings</b>	<b>£640</b>	<b>3.23 kg/m<sup>2</sup></b>	

Potential energy efficiency rating: D 65  
 Potential environmental impact rating: C 76

Fuel prices for cost data on this page from database revision number 548 TEST (07 Jun 2024)  
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£358	£372	-£14
Bulk LPG	£3083	£2953	£130
Space heating	£2827	£2833	-£5
Water heating	£277	£156	£120
Lighting	£336	£336	£0
Generated (PV)	-£0	-£525	£525
<b>Total cost of fuels</b>	<b>£3441</b>	<b>£2800</b>	<b>£641</b>
<b>Total cost of uses</b>	<b>£3440</b>	<b>£2800</b>	<b>£640</b>
Delivered energy	86 kWh/m <sup>2</sup>	78 kWh/m <sup>2</sup>	8 kWh/m <sup>2</sup>
Carbon dioxide emissions	8.4 tonnes	7.1 tonnes	1.3 tonnes
CO2 emissions per m <sup>2</sup>	22 kg/m <sup>2</sup>	18 kg/m <sup>2</sup>	3 kg/m <sup>2</sup>
Primary energy	100 kWh/m <sup>2</sup>	82 kWh/m <sup>2</sup>	18 kWh/m <sup>2</sup>

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

### 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	161.3200 (1b)	x 2.3500 (2b)	= 379.1020 (1b) - (3b)
First floor	150.6300 (1c)	x 2.7200 (2c)	= 409.7136 (1c) - (3c)
Second floor	76.6000 (1d)	x 3.8900 (2d)	= 297.9740 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	388.5500		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 1086.7896 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (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) =					50.0000 / (5) = 0.0460 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.7960 (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) =	0.7363 (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	0.9388	0.9204	0.9020	0.8099	0.7915	0.6995	0.6995	0.6811	0.7363	0.7915	0.8283	0.8652 (22b)
Effective ac	0.9407	0.9236	0.9068	0.8280	0.8133	0.7446	0.7446	0.7319	0.7711	0.8133	0.8431	0.8743 (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
Windows (Uw = 1.60)			40.2300	1.5038	60.4962		(27)
Glazed doors			2.4300	1.6000	3.8880		(26a)
Solid doors			4.3900	1.6000	7.0240		(26)
Velux (Uw = 1.40)			1.9600	1.3258	2.5985		(27a)
Ground floor			161.3200	0.2100	33.8772		(28a)
Stone walls	299.4900	37.5600	261.9300	0.3200	83.8176		(29a)
Brick walls	108.5300	9.4900	99.0400	0.3100	30.7024		(29a)
Sloping ceilings	224.0700	1.9600	222.1100	0.1700	37.7587		(30)
Total net area of external elements Aum(A, m2)			793.4100				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 260.1626		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							119.0115 (36)
Total fabric heat loss						(33) + (36) =	379.1741 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	337.3603	331.2234	325.2081	296.9541	291.6678	267.0595	267.0595	262.5024	276.5383	291.6678	302.3618	313.5419 (38)
Heat transfer coeff	716.5344	710.3976	704.3822	676.1282	670.8420	646.2337	646.2337	641.6766	655.7124	670.8420	681.5360	692.7160 (39)
Average = Sum(39)m / 12 =												676.1029 (39)
HLP	1.8441	1.8283	1.8128	1.7401	1.7265	1.6632	1.6632	1.6515	1.6876	1.7265	1.7540	1.7828 (40)
HLP (average)												1.7401 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.2470 (42)
Average daily hot water use (litres/day)												111.3173 (43)
Daily hot water use	122.4491	117.9964	113.5437	109.0910	104.6383	100.1856	100.1856	104.6383	109.0910	113.5437	117.9964	122.4491 (44)
Energy conte	181.5884	158.8184	163.8863	142.8801	137.0968	118.3042	109.6262	125.7977	127.3001	148.3560	161.9421	175.8587 (45)
Energy content (annual)												Total = Sum(45)m = 1751.4549 (45)
Distribution loss (46)m = 0.15 x (45)m	27.2383	23.8228	24.5830	21.4320	20.5645	17.7456	16.4439	18.8696	19.0950	22.2534	24.2913	26.3788 (46)



# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

MIT	15.9990	16.2846	16.8229	17.6393	18.4017	19.1131	19.4529	19.4099	18.8765	17.8978	16.8761	16.0377 (92)
Temperature adjustment												0.0000
adjusted MIT	15.9990	16.2846	16.8229	17.6393	18.4017	19.1131	19.4529	19.4099	18.8765	17.8978	16.8761	16.0377 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9704	0.9586	0.9390	0.9017	0.8368	0.7261	0.5840	0.6292	0.8055	0.9169	0.9597	0.9738 (94)
Useful gains	1556.6086	1806.1907	2008.6701	2158.7193	2144.9260	1834.3843	1409.7714	1404.8890	1652.6775	1647.9753	1521.4451	1473.7705 (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	8382.7136	8087.5965	7271.2975	5908.8922	4495.7513	2916.5130	1843.6158	1931.3511	3131.9870	4895.6478	6662.7654	8200.1369 (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	5078.6221	4221.1047	3915.3948	2700.1245	1749.0141	0.0000	0.0000	0.0000	0.0000	2416.2683	3701.7506	5004.4166 (98)
Space heating												28786.6956 (98)
Space heating per m2												(98) / (4) = 74.0875 (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 %)												89.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												32020.7960 (211)
Space heating requirement	5078.6221	4221.1047	3915.3948	2700.1245	1749.0141	0.0000	0.0000	0.0000	0.0000	2416.2683	3701.7506	5004.4166 (98)
Space heating efficiency (main heating system 1)	89.9000	89.9000	89.9000	89.9000	89.9000	0.0000	0.0000	0.0000	0.0000	89.9000	89.9000	89.9000 (210)
Space heating fuel (main heating system)	5649.1903	4695.3333	4355.2779	3003.4755	1945.5107	0.0000	0.0000	0.0000	0.0000	2687.7289	4117.6314	5566.6480 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	208.2596	160.9865	136.4104	80.5737	44.8553	26.7354	21.1723	54.7856	85.9612	141.1781	181.4984	207.2027 (64)
Efficiency of water heater (217)m	89.4241	89.4560	89.4930	89.5494	89.5973	79.2000	79.2000	79.2000	79.2000	89.2345	89.3359	79.2000 (216)
Fuel for water heating, kWh/month	232.8898	179.9616	152.4259	89.9768	50.0632	33.7569	26.7327	69.1737	108.5369	158.2102	203.1640	231.7193 (219)
Water heating fuel used												1536.6109 (219)
Annual totals kWh/year												
Space heating fuel - main system												32020.7960 (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)												1173.3647 (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												33128.5322 (238)

#### 10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	32020.7960	7.6000	2433.5805 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1536.6109	7.6000	116.7824 (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	1173.3647	13.1900	154.7668 (250)
Additional standing charges			70.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			2563.7944 (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] =	2.4837 (257)
SAP value		65.3529
SAP rating (Section 12)		65 (258)
SAP band		D

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

### CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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 12a. Carbon dioxide emissions - Individual heating systems including micro-CHP  
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	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	32020.7960	0.2410	7717.0118 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1536.6109	0.2410	370.3232 (264)
Space and water heating			8087.3351 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	1173.3647	0.5190	608.9763 (268)
Energy saving/generation technologies			
PV Unit			
Total kg/year	-1727.2394	0.5190	-896.4372 (269)
CO2 emissions per m2			7864.7491 (272)
EI value			20.2400 (273)
EI rating			75.6919
EI band			76 (274) C

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# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

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

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	161.3200 (1b)	x 2.3500 (2b)	= 379.1020 (1b) - (3b)
First floor	150.6300 (1c)	x 2.7200 (2c)	= 409.7136 (1c) - (3c)
Second floor	76.6000 (1d)	x 3.8900 (2d)	= 297.9740 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	388.5500		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 1086.7896 (5)

#### 2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 50.0000 / (5) = 0.0460 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.7960 (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) =		0.7363 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.1000	4.0000	3.5000	3.5000	3.1000	3.1000	2.9000	3.1000	3.3000	3.4000	3.6000 (22)
Wind factor	1.0500	1.0250	1.0000	0.8750	0.8750	0.7750	0.7750	0.7250	0.7750	0.8250	0.8500	0.9000 (22a)
Adj infilt rate	0.7731	0.7547	0.7363	0.6443	0.6443	0.5706	0.5706	0.5338	0.5706	0.6075	0.6259	0.6627 (22b)
Effective ac	0.7989	0.7848	0.7711	0.7075	0.7075	0.6628	0.6628	0.6425	0.6628	0.6845	0.6959	0.7196 (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
Windows (Uw = 1.60)			40.2300	1.5038	60.4962		(27)
Glazed doors			2.4300	1.6000	3.8880		(26a)
Solid doors			4.3900	1.6000	7.0240		(26)
Velux (Uw = 1.40)			1.9600	1.3258	2.5985		(27a)
Ground floor			161.3200	0.2100	33.8772		(28a)
Stone walls	299.4900	37.5600	261.9300	0.3200	83.8176		(29a)
Brick walls	108.5300	9.4900	99.0400	0.3100	30.7024		(29a)
Sloping ceilings	224.0700	1.9600	222.1100	0.1700	37.7587		(30)
Total net area of external elements Aum(A, m2)			793.4100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26) ... (30) + (32) =	260.1626		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							100.0000 (35)
Thermal bridges (Default value 0.150 * total exposed area)							119.0115 (36)
Total fabric heat loss						(33) + (36) =	379.1741 (37)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	286.5031	281.4600	276.5383	253.7528	253.7528	237.7119	237.7119	230.4205	237.7119	245.4893	249.5603	258.0669 (38)
Heat transfer coeff	665.6773	660.6341	655.7124	632.9269	632.9269	616.8860	616.8860	609.5946	616.8860	624.6634	628.7344	637.2410 (39)
Average = Sum(39)m / 12 =												633.2308 (39)
HLP	1.7132	1.7003	1.6876	1.6289	1.6289	1.5877	1.5877	1.5689	1.5877	1.6077	1.6182	1.6400 (40)
HLP (average)												1.6297 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

#### 4. Water heating energy requirements (kWh/year)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Assumed occupancy												3.2470 (42)
Average daily hot water use (litres/day)												111.3173 (43)
Daily hot water use	122.4491	117.9964	113.5437	109.0910	104.6383	100.1856	100.1856	104.6383	109.0910	113.5437	117.9964	122.4491 (44)
Energy conte	181.5884	158.8184	163.8863	142.8801	137.0968	118.3042	109.6262	125.7977	127.3001	148.3560	161.9421	175.8587 (45)
Energy content (annual)												Total = Sum(45)m = 1751.4549 (45)
Distribution loss (46)m = 0.15 x (45)m	27.2383	23.8228	24.5830	21.4320	20.5645	17.7456	16.4439	18.8696	19.0950	22.2534	24.2913	26.3788 (46)





# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

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

MIT	16.2907	16.5309	17.0923	17.8798	18.5825	19.2334	19.4949	19.4769	18.9801	18.0713	17.1358	16.3256 (92)
Temperature adjustment												0.0000
adjusted MIT	16.2907	16.5309	17.0923	17.8798	18.5825	19.2334	19.4949	19.4769	18.9801	18.0713	17.1358	16.3256 (93)

#### 8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9684	0.9580	0.9353	0.8937	0.8266	0.7027	0.5904	0.6216	0.7995	0.9140	0.9574	0.9733 (94)
Useful gains	1612.9803	1823.6856	2048.4312	2203.1939	2143.5738	1860.4977	1467.9639	1443.0089	1693.3489	1677.9942	1571.4467	1508.2547 (95)
Ext temp.	4.5000	5.0000	6.7000	9.1000	11.9000	14.7000	16.4000	16.3000	14.0000	10.6000	7.2000	4.3000 (96)
Heat loss rate W	7848.7745	7617.7016	6814.3294	5556.9919	4229.5528	2796.5914	1909.1766	1936.6243	3072.1697	4667.0172	6247.0002	7663.1738 (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	4639.4309	3893.5788	3545.8283	2414.7346	1551.9684	0.0000	0.0000	0.0000	0.0000	2223.8332	3366.3986	4579.2598 (98)
Space heating												26215.0325 (98)
Space heating per m2												(98) / (4) = 67.4689 (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 %)												89.9000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												29160.2141 (211)
Space heating requirement	4639.4309	3893.5788	3545.8283	2414.7346	1551.9684	0.0000	0.0000	0.0000	0.0000	2223.8332	3366.3986	4579.2598 (98)
Space heating efficiency (main heating system 1)	89.9000	89.9000	89.9000	89.9000	89.9000	0.0000	0.0000	0.0000	0.0000	89.9000	89.9000	89.9000 (210)
Space heating fuel (main heating system)	5160.6573	4331.0109	3944.1916	2686.0229	1726.3275	0.0000	0.0000	0.0000	0.0000	2473.6743	3744.6035	5093.7262 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	204.5754	160.9561	134.7643	78.5660	47.1820	21.9840	19.9605	51.4533	83.5514	139.9060	178.4273	205.2489 (64)
Efficiency of water heater (217)m	89.3900	89.4204	89.4575	89.5189	89.5431	79.2000	79.2000	79.2000	79.2000	89.1868	89.2928	79.2000 (216)
Fuel for water heating, kWh/month	228.8572	179.9993	150.6462	87.7647	52.6920	27.7575	25.2026	64.9663	105.4942	156.8684	199.8227	229.6312 (219)
Water heating fuel used												1509.7022 (219)
Annual totals kWh/year												
Space heating fuel - main system												29160.2141 (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)												1173.3647 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1144 * 0.80) =									-1830.6231			-1830.6231 (233)
Total delivered energy for all uses												30137.6580 (238)

#### 10a. Fuel costs - using BEDF prices (548)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	29160.2141	9.4000	2741.0601 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1509.7022	9.4000	141.9120 (247)
Pumps and fans for heating	75.0000	28.6600	21.4950 (249)
Pump for solar water heating	50.0000	28.6600	14.3300 (249)
Energy for lighting	1173.3647	28.6600	336.2863 (250)
Additional standing charges			70.0000 (251)
Energy saving/generation technologies			
PV Unit	-1830.6231	28.6600	-524.6566 (252)
Total energy cost			2800.4269 (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	29160.2141	0.2410	7027.6116 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1509.7022	0.2410	363.8382 (264)

# FULL SAP CALCULATION PRINTOUT

## Calculation Type: Conversion (As Built)

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

Space and water heating			7391.4498 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	1173.3647	0.5190	608.9763 (268)
Energy saving/generation technologies			
PV Unit	-1830.6231	0.5190	-950.0934 (269)
Total kg/year			7115.2077 (272)

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 13a. Primary energy - Individual heating systems including micro-CHP  
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	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	29160.2141	1.0900	31784.6334 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1509.7022	1.0900	1645.5754 (264)
Space and water heating			33430.2088 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	1173.3647	3.0700	3602.2296 (268)
Energy saving/generation technologies			
PV Unit	-1830.6231	3.0700	-5620.0129 (269)
Primary energy kWh/year			31796.1756 (272)
Primary energy kWh/m2/year			81.8329 (273)