



elmhurst
energy



SAP Report Submission for Building Regulations Compliance

Client:

Project: Fernley House, Brinsea
Congresbury, BRISTOL, BS49 5JP

Contact: Michael Heinemans
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Report Issue Date: 28/09/2021

EXCELLENCE
IN ENERGY
ASSESSMENT

FULL SAP CALCULATION PRINTOUT

Calculation Type: Conversion (As Built)

Property Reference	200047	Issued on Date	28/09/2021
Assessment Reference	001	Prop Type Ref	3 Brinsea Batch BS49 5JP
Property	Fernley House, Brinsea, Congresbury, BRISTOL, BS49 5JP		

SAP Rating	63 D	DER	N/A	TER	N/A
Environmental	75 C	% DER<TER	N/A		
CO ₂ Emissions (t/year)	2.93	DFEE	N/A	TFFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFFEE	N/A		

Assessor Details	Mr. Michael Heinemans, DEA 4 U, Tel: 01275 878257, mhmmmb@yahoo.co.uk	Assessor ID	D395-0001
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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 ²)	Storey height (m)	Volume (m ³)
Ground floor	68.9800 (1b)	2.4000 (2b)	165.5520 (1b) - (3b)
First floor	68.9800 (1c)	2.9900 (2c)	206.2502 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.9600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 371.8022 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ 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) =	0.1345 (8)						
Pressure test					No							
Measured/design AP50					15.0000							
Infiltration rate					0.8845 (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) =	0.7518 (21)						
Wind speed	Jan 4.5000	Feb 4.2000	Mar 4.3000	Apr 4.0000	May 4.1000	Jun 3.7000	Jul 3.9000	Aug 3.6000	Sep 3.6000	Oct 3.9000	Nov 3.9000	Dec 4.2000 (22)
Wind factor	1.1250	1.0500	1.0750	1.0000	1.0250	0.9250	0.9750	0.9000	0.9000	0.9750	0.9750	1.0500 (22a)
Adj infiltr rate	0.8458	0.7894	0.8082	0.7518	0.7706	0.6954	0.7330	0.6766	0.6766	0.7330	0.7330	0.7894 (22b)
Effective ac	0.8577	0.8116	0.8266	0.7826	0.7969	0.7418	0.7687	0.7289	0.7289	0.7687	0.7687	0.8116 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 window (Uw = 1.60)			16.4000	1.5038	24.6617		(27)
Opening Type 2 door			1.8000	1.6000	2.8800		(26)
Opening Type 3 velux (Uw = 1.30)			2.6900	1.2357	3.3241		(27a)
Heat Loss Floor 1			68.9800	0.1000	6.8980	78.0000	5380.4400 (28a)
External Wall 1 cavity	39.9600	10.6000	29.3600	0.2800	8.2208	41.6000	1221.3760 (29a)
External Wall 2 timber frame	48.1200	7.6000	40.5200	0.1600	6.4832	20.3200	823.3664 (29a)
External Roof 1	45.3400	2.6900	42.6500	0.1500	6.3975	9.0000	383.8500 (30)
External Roof 2	50.2400		50.2400	0.1600	8.0384	15.7000	788.7680 (30)
Total net area of external elements Aum(A, m ²)			252.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.9037		(33)
Party Wall 1			88.0800	0.0000	0.0000	70.0000	6165.6000 (32)
Internal Wall 1			89.5200			75.0000	6714.0000 (32c)
Internal Wall 2			130.6200			9.0000	1175.5800 (32c)
Internal Floor 1			68.9800			18.0000	1241.6400 (32d)
Internal Ceiling 1			68.9800			9.0000	620.8200 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	24515.4404 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							177.6996 (35)

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Thermal bridges (Default value 0.150 * total exposed area)												37.8960 (36)
Total fabric heat loss	(33) + (36) =											104.7997 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	105.2322	99.5760	101.4181	96.0218	97.7772	91.0157	94.3098	89.4337	89.4337	94.3098	94.3098	99.5760
Average = Sum(39)m / 12 =												200.8342 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.5224	1.4814	1.4948	1.4557	1.4684	1.4194	1.4432	1.4079	1.4079	1.4432	1.4432	1.4814
Days in month	31	28	31	30	31	30	31	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.9131 (42)
Average daily hot water use (litres/day)												103.3861 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.7247	109.5893	105.4538	101.3184	97.1829	93.0475	93.0475	97.1829	101.3184	105.4538	109.5893	113.7247
Energy content (annual)	168.6504	147.5027	152.2096	132.7000	127.3288	109.8751	101.8154	116.8347	118.2301	137.7858	150.4039	163.3289
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1626.6657 (45)
Water storage loss:												24.4993 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
If cylinder contains dedicated solar storage												0.0000 (56)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5234	45.8864	47.4160	49.5234	49.3151	50.9589	49.3151	50.9589
Total heat required for water heating calculated for each month	219.6093	193.5301	203.1685	182.0151	176.8522	155.7615	149.2314	166.3581	167.5452	188.7447	199.7190	214.2878
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
Output from w/h	219.6093	193.5301	203.1685	182.0151	176.8522	155.7615	149.2314	166.3581	167.5452	188.7447	199.7190	214.2878
RHI water heating demand												2217 (64)
Heat gains from water heating, kWh/month	68.8160	60.5515	63.3494	56.4515	54.7177	48.0051	45.7076	51.2284	51.6403	58.5535	62.3381	67.0466

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	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.1583	64.9785	52.8441	40.0064	29.9052	25.2473	27.2806	35.4603	47.5947	60.4325	70.5336	75.1916
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	458.3290	463.0850	451.1000	425.5853	393.3776	363.1069	342.8842	338.1282	350.1132	375.6279	407.8356	438.1063
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917
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
Losses e.g. evaporation (negative values) (Table 5)	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239
Water heating gains (Table 5)	92.4946	90.1064	85.1471	78.4049	73.5453	66.6737	61.4350	68.8553	71.7226	78.7009	86.5807	90.1164
Total internal gains	740.6356	734.8236	705.7448	660.6503	613.4818	571.6815	548.2534	559.0975	586.0842	631.4149	681.6035	720.0679

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W						
Northeast	12.8000	14.2063	0.7600	0.7000	0.7700	67.0401 (75)						
Northwest	3.6000	14.2063	0.7600	0.7000	0.7700	18.8550 (81)						
Northwest	2.6900	33.0000	0.7600	0.7000	1.0000	42.5031 (82)						
Solar gains	128.3982	231.4341	414.7018	693.8804	868.9177	997.8294	902.0852	745.2476	531.0893	293.7729	158.8287	101.7663
Total gains	869.0337	966.2577	1120.4467	1354.5307	1482.3995	1569.5110	1450.3386	1304.3451	1117.1735	925.1879	840.4322	821.8342

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th _l (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	32.4229	33.3202	33.0226	33.9099	33.6161	34.7769	34.2015	35.0601	35.0601	34.2015	34.2015	33.3202
alpha	3.1615	3.2213	3.2015	3.2607	3.2411	3.3185	3.2801	3.3373	3.3373	3.2801	3.2801	3.2213
util living area	0.9887	0.9833	0.9662	0.9140	0.8099	0.6013	0.4902	0.5144	0.7854	0.9458	0.9814	0.9904
MIT	20.2585	20.3162	20.4047	20.5440	20.6519	20.7327	20.7441	20.7477	20.6978	20.5520	20.4060	20.2674

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Th 2	19.6707	19.7015	19.6914	19.7209	19.7113	19.7485	19.7303	19.7573	19.7573	19.7303	19.7303	19.7015 (88)
util rest of house												
	0.9855	0.9785	0.9559	0.8872	0.7476	0.4878	0.3402	0.3577	0.6918	0.9225	0.9750	0.9876 (89)
MIT 2	18.9853	19.0710	19.1488	19.3103	19.3979	19.4951	19.4817	19.5127	19.4835	19.3300	19.1874	19.0228 (90)
Living area fraction									fLA = Living area / (4) =			0.2022 (91)
MIT	19.2427	19.3228	19.4027	19.5597	19.6514	19.7453	19.7369	19.7624	19.7290	19.5771	19.4338	19.2744 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2427	19.3228	19.4027	19.5597	19.6514	19.7453	19.7369	19.7624	19.7290	19.5771	19.4338	19.2744 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9842	0.9768	0.9532	0.8832	0.7442	0.4875	0.3411	0.3584	0.6893	0.9189	0.9732	0.9865	(94)
Useful gains	855.2854	943.8257	1067.9805	1196.3225	1103.2377	765.0623	494.6560	467.4895	770.0325	850.1725	817.8669	810.7487	(95)
Ext temp.	5.5000	6.0000	7.6000	9.8000	12.7000	15.6000	17.2000	17.3000	15.0000	11.7000	8.4000	5.5000	(96)
Heat loss rate W													
2886.3975	2722.8494	2433.9233	1959.9583	1408.1880	811.7128	505.1202	478.2741	918.5237	1568.3955	2196.9284	2815.1482	(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													
1511.1473	1195.5039	1016.2614	549.8178	226.8830	0.0000	0.0000	0.0000	0.0000	534.3579	992.9242	1491.2733	(98)	
Space heating													
RHI space heating demand												7518.1689	(98)
												7518	(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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.9800 (1b)	x 2.4000 (2b)	= 165.5520 (1b) - (3b)
First floor	68.9800 (1c)	x 2.9900 (2c)	= 206.2502 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.9600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 371.8022 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					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) = 0.1345 (8)							
Pressure test					No							
Measured/design AP50					15.0000							
Infiltration rate					0.8845 (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) =	0.7518 (21)							
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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												
Effective ac	0.9586	0.9398	0.9210	0.8270	0.8082	0.7142	0.7142	0.6954	0.7518	0.8082	0.8458	0.8834 (22b)
	0.9594	0.9416	0.9241	0.8420	0.8266	0.7551	0.7551	0.7418	0.7826	0.8266	0.8577	0.8902 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 window (Uw = 1.60)			16.4000	1.5038	24.6617		(27)
Opening Type 2 door			1.8000	1.6000	2.8800		(26)
Opening Type 3 velux (Uw = 1.30)			2.6900	1.2357	3.3241		(27a)
Heat Loss Floor 1			68.9800	0.1000	6.8980	78.0000	5380.4400 (28a)
External Wall 1 cavity	39.9600	10.6000	29.3600	0.2800	8.2208	41.6000	1221.3760 (29a)
External Wall 2 timber frame	48.1200	7.6000	40.5200	0.1600	6.4832	20.3200	823.3664 (29a)
External Roof 1	45.3400	2.6900	42.6500	0.1500	6.3975	9.0000	383.8500 (30)
External Roof 2	50.2400		50.2400	0.1600	8.0384	15.7000	788.7680 (30)
Total net area of external elements Aum(A, m ²)			252.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.9037		(33)
Party Wall 1			88.0800	0.0000	0.0000	70.0000	6165.6000 (32)
Internal Wall 1			89.5200			75.0000	6714.0000 (32c)
Internal Wall 2			130.6200			9.0000	1175.5800 (32c)
Internal Floor 1			68.9800			18.0000	1241.6400 (32d)
Internal Ceiling 1			68.9800			18.0000	1241.6400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		25136.2604 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.1996 (35)
Thermal bridges (Default value 0.150 * total exposed area)							37.8960 (36)
Total fabric heat loss						(33) + (36) =	104.7997 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	117.7151	115.5262	113.3807	103.3035	101.4181	92.6411	92.6411	91.0157	96.0218	101.4181	105.2322	109.2198 (38)
Average = Sum(39)m / 12 =	222.5148	220.3259	218.1804	208.1032	206.2178	197.4408	197.4408	195.8154	200.8215	206.2178	210.0319	214.0195 (39)
HLP	1.6129	1.5970	1.5815	1.5084	1.4948	1.4311	1.4311	1.4194	1.4557	1.4948	1.5224	1.5513 (40)
HLP (average)												1.5084 (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												2.9131 (42)
Average daily hot water use (litres/day)												103.3861 (43)
Daily hot water use												

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Energy conte	113.7247	109.5893	105.4538	101.3184	97.1829	93.0475	93.0475	97.1829	101.3184	105.4538	109.5893	113.7247 (44)
Energy conte	168.6504	147.5027	152.2096	132.7000	127.3288	109.8751	101.8154	116.8347	118.2301	137.7858	150.4039	163.3289 (45)
Energy content (annual)	Total = Sum(45)m = 1626.6657 (45)											
Distribution loss (46)m = 0.15 x (45)m												
	25.2976	22.1254	22.8314	19.9050	19.0993	16.4813	15.2723	17.5252	17.7345	20.6679	22.5606	24.4993 (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	50.9589	46.0274	50.9589	49.3151	49.5234	45.8864	47.4160	49.5234	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
	219.6093	193.5301	203.1685	182.0151	176.8522	155.7615	149.2314	166.3581	167.5452	188.7447	199.7190	214.2878 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
	219.6093	193.5301	203.1685	182.0151	176.8522	155.7615	149.2314	166.3581	167.5452	188.7447	199.7190	214.2878 (64)
Heat gains from water heating, kWh/month	Total per year (kWh/year) = Sum(64)m = 2216.8230 (64)											
	68.8160	60.5515	63.3494	56.4515	54.7177	48.0051	45.7076	51.2284	51.6403	58.5535	62.3381	67.0466 (65)

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

Metabolic gains (Table 5), Watts												
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	73.1583	64.9785	52.8441	40.0064	29.9052	25.2473	27.2806	35.4603	47.5947	60.4325	70.5336	75.1916 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	458.3290	463.0850	451.0000	425.5853	393.3776	363.1069	342.8842	338.1282	350.1132	375.6279	407.8356	438.1063 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917 (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)												
	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239 (71)
Water heating gains (Table 5)												
	92.4946	90.1064	85.1471	78.4049	73.5453	66.6737	61.4350	68.8553	71.7226	78.7009	86.5807	90.1164 (72)
Total internal gains	740.6356	734.8236	705.7448	660.6503	613.4818	571.6815	548.2534	559.0975	586.0842	631.4149	681.6035	720.0679 (73)

6. Solar gains

[Jan]	Area	Solar flux	g	Specific data	FF	Access	Gains					
	m ²	Table 6a	W/m ²	or Table 6b	or Table 6c	factor	W					
						Table 6d						
Northeast	12.8000	11.2829	0.7600		0.7000	0.7700	53.2448 (75)					
Northwest	3.6000	11.2829	0.7600		0.7000	0.7700	14.9751 (81)					
Northwest	2.6900	26.0000	0.7600		0.7000	1.0000	33.4873 (82)					
Solar gains	101.7072	208.4141	373.8333	604.0763	799.5947	846.4090	794.2507	641.3349	452.9748	254.7084	128.3414	82.7592 (83)
Total gains	842.3427	943.2377	1079.5781	1264.7266	1413.0765	1418.0905	1342.5041	1200.4324	1039.0590	886.1234	809.9449	802.8271 (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	31.3790	31.6908	32.0024	33.5521	33.8588	35.3640	35.3640	35.6575	34.7687	33.8588	33.2440	32.6246
alpha	3.0919	3.1127	3.1335	3.2368	3.2573	3.3576	3.3576	3.3772	3.3179	3.2573	3.2163	3.1750
util living area	0.9921	0.9881	0.9771	0.9434	0.8662	0.7242	0.5848	0.6511	0.8647	0.9662	0.9883	0.9933 (86)
MIT	20.1753	20.2272	20.3269	20.4853	20.6126	20.7110	20.7421	20.7361	20.6577	20.4933	20.3261	20.1909 (87)
Th 2	19.6039	19.6155	19.6269	19.6812	19.6914	19.7395	19.7395	19.7485	19.7209	19.6914	19.6707	19.6492 (88)
util rest of house	0.9899	0.9847	0.9702	0.9252	0.8202	0.6294	0.4425	0.5116	0.7992	0.9521	0.9844	0.9915 (89)
MIT 2	18.8396	18.9019	19.0114	19.2167	19.3451	19.4737	19.4934	19.5005	19.4168	19.2364	19.0519	18.8972 (90)
Living area fraction	fLA = Living area / (4) = 0.2022 (91)											
MIT	19.1097	19.1698	19.2773	19.4732	19.6014	19.7239	19.7458	19.7503	19.6677	19.4905	19.3095	19.1587 (92)
Temperature adjustment	0.0000											
adjusted MIT	19.1097	19.1698	19.2773	19.4732	19.6014	19.7239	19.7458	19.7503	19.6677	19.4905	19.3095	19.1587 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9890	0.9834	0.9680	0.9217	0.8164	0.6280	0.4433	0.5118	0.7957	0.9493	0.9831	0.9907 (94)
Useful gains	833.0698	927.5605	1045.0463	1165.6681	1153.6486	890.5674	595.1162	614.4186	826.8197	841.2156	796.2310	795.3575 (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												
	3295.3661	3144.0173	2787.7644	2200.3118	1629.4040	1011.6586	621.1088	656.0386	1118.1062	1833.3773	2564.3889	3201.4610 (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	1831.9485	1489.4590	1296.5823	744.9434	353.9620	0.0000	0.0000	0.0000	0.0000	738.1683	1273.0737	1790.1410 (98)
Space heating	9518.2783 (98)											
Space heating per m ²	(98) / (4) = 68.9930 (99)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: Conversion (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													10517.4345 (211)
Space heating requirement	1831.9485	1489.4590	1296.5823	744.9434	353.9620	0.0000	0.0000	0.0000	0.0000	738.1683	1273.0737	1790.1410	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	2024.2525	1645.8110	1432.6877	823.1419	391.1182	0.0000	0.0000	0.0000	0.0000	815.6555	1406.7113	1978.0564	(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	219.6093	193.5301	203.1685	182.0151	176.8522	155.7615	149.2314	166.3581	167.5452	188.7447	199.7190	214.2878	(64)
Efficiency of water heater (217)m	89.2992	89.2113	88.9857	88.3214	86.8644	80.4000	80.4000	80.4000	80.4000	88.2427	88.9842	89.3007	(217)
Fuel for water heating, kWh/month	245.9254	216.9346	228.3160	206.0827	203.5957	193.7333	185.6112	206.9130	208.3895	213.8926	224.4433	239.9621	(219)
Water heating fuel used													2573.7994 (219)
Annual totals kWh/year													
Space heating fuel - main system													10517.4345 (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)													516.7992 (232)
Total delivered energy for all uses													13683.0332 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10517.4345	7.6000	799.3250	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2573.7994	7.6000	195.6088	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	516.7992	13.1900	68.1658	(250)
Additional standing charges			70.0000	(251)
Total energy cost			1142.9921	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$	2.6238 (257)
SAP value		63.3975
SAP rating (Section 12)		63 (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	10517.4345	0.2410	2534.7017	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2573.7994	0.2410	620.2856	(264)
Space and water heating			3154.9874	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	516.7992	0.5190	268.2188	(268)
Total kg/year			3462.1312	(272)
CO2 emissions per m2			25.1000	(273)
EI value			74.6433	
EI rating			75	(274)
EI band			C	

Calculation of stars for heating and DHW

Main heating energy efficiency	$7.60 \times (1 + 0.29 \times 0.75) / 0.9050 = 10.224$, stars = 2
Main heating environmental impact	$0.241 \times (1 + 0.29 \times 0.75) / 0.9050 = 0.3242$, stars = 4
Water heating energy efficiency	$7.60 / 0.8590 = 8.847$, stars = 2
Water heating environmental impact	$0.241 / 0.8590 = 0.2806$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: Conversion (As Built)

CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	68.9800 (1b)	2.4000 (2b)	165.5520 (1b) - (3b)
First floor	68.9800 (1c)	2.9900 (2c)	206.2502 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.9600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 371.8022 (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				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) =	0.1345 (8)
Pressure test				No	
Measured/design AP50					15.0000
Infiltration rate					0.8845 (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) =		0.7518 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.5000	4.2000	4.3000	4.0000	4.1000	3.7000	3.9000	3.6000	3.6000	3.9000	3.9000	4.2000 (22)
Wind factor	1.1250	1.0500	1.0750	1.0000	1.0250	0.9250	0.9750	0.9000	0.9000	0.9750	0.9750	1.0500 (22a)
Adj infilt rate												
Effective ac	0.8458	0.7894	0.8082	0.7518	0.7706	0.6954	0.7330	0.6766	0.6766	0.7330	0.7330	0.7894 (22b)
	0.8577	0.8116	0.8266	0.7826	0.7969	0.7418	0.7687	0.7289	0.7289	0.7687	0.7687	0.8116 (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
Opening Type 1 window (Uw = 1.60)			16.4000	1.5038	24.6617		(27)
Opening Type 2 door			1.8000	1.6000	2.8800		(26)
Opening Type 3 velux (Uw = 1.30)			2.6900	1.2357	3.3241		(27a)
Heat Loss Floor 1			68.9800	0.1000	6.8980	78.0000	5380.4400 (28a)
External Wall 1 cavity	39.9600	10.6000	29.3600	0.2800	8.2208	41.6000	1221.3760 (29a)
External Wall 2 timber frame	48.1200	7.6000	40.5200	0.1600	6.4832	20.3200	823.3664 (29a)
External Roof 1	45.3400	2.6900	42.6500	0.1500	6.3975	9.0000	383.8500 (30)
External Roof 2	50.2400		50.2400	0.1600	8.0384	15.7000	788.7680 (30)
Total net area of external elements Aum(A, m2)			252.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.9037		(33)
Party Wall 1			88.0800	0.0000	0.0000	70.0000	6165.6000 (32)
Internal Wall 1			89.5200			75.0000	6714.0000 (32c)
Internal Wall 2			130.6200			9.0000	1175.5800 (32c)
Internal Floor 1			68.9800			18.0000	1241.6400 (32d)
Internal Ceiling 1			68.9800			18.0000	1241.6400 (32e)
Heat capacity Cm = Sum(A x k)					(28)...(30) + (32) + (32a)...(32e) =		25136.2604 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							182.1996 (35)
Thermal bridges (Default value 0.150 * total exposed area)							37.8960 (36)
Total fabric heat loss						(33) + (36) =	104.7997 (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	105.2322	99.5760	101.4181	96.0218	97.7772	91.0157	94.3098	89.4337	89.4337	94.3098	94.3098	99.5760 (38)
Heat transfer coeff	210.0319	204.3757	206.2178	200.8215	202.5769	195.8154	199.1095	194.2334	194.2334	199.1095	199.1095	204.3757 (39)
Average = Sum(39)m / 12 =												200.8342 (39)
HLP	1.5224	1.4814	1.4948	1.4557	1.4684	1.4194	1.4432	1.4079	1.4079	1.4432	1.4432	1.4814 (40)
HLP (average)												1.4557 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average daily hot water use (litres/day)												2.9131 (42)
												103.3861 (43)
Daily hot water use												

FULL SAP CALCULATION PRINTOUT

Calculation Type: Conversion (As Built)

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

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													8304.5318 (211)
Space heating requirement	1512.3101	1196.1215	1015.9576	547.7761	224.1035	0.0000	0.0000	0.0000	0.0000	533.4738	993.3745	1492.4841	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1671.0608	1321.6813	1122.6051	605.2775	247.6282	0.0000	0.0000	0.0000	0.0000	589.4739	1097.6514	1649.1537	(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	219.6093	193.5301	203.1685	182.0151	176.8522	155.7615	149.2314	166.3581	167.5452	188.7447	199.7190	214.2878	(64)
Efficiency of water heater (217)m	89.0810	88.9439	88.6442	87.7507	85.7488	80.4000	80.4000	80.4000	80.4000	87.6233	88.6361	89.0948	(216)
Fuel for water heating, kWh/month	246.5276	217.5866	229.1954	207.4230	206.2446	193.7333	185.6112	206.9130	208.3895	215.4046	225.3247	240.5167	(219)
Water heating fuel used													2582.8702 (219)
Annual totals kWh/year													
Space heating fuel - main system													8304.5318 (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)													516.7992 (232)
Total delivered energy for all uses													11479.2013 (238)

10a. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	8304.5318	6.8300	567.1995 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2582.8702	6.8300	176.4100 (247)
Pumps and fans for heating	75.0000	19.1200	14.3400 (249)
Energy for lighting	516.7992	19.1200	98.8120 (250)
Additional standing charges			62.0000 (251)
Total energy cost			918.7616 (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	8304.5318	0.2410	2001.3922 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2582.8702	0.2410	622.4717 (264)
Space and water heating			2623.8639 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	516.7992	0.5190	268.2188 (268)
Total kg/year			2931.0077 (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	8304.5318	1.0900	9051.9396 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2582.8702	1.0900	2815.3286 (264)
Space and water heating			11867.2682 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	516.7992	3.0700	1586.5737 (268)
Primary energy kWh/year			13684.0919 (272)
Primary energy kWh/m2/year			99.1888 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:

D 63

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

Current environmental impact rating:

C 75

(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	Recommended
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 2.4	-£ 66	-240 kg (8.2%)
U Solar photovoltaic panels	+ 7.3	-£ 371	-1006 kg (37.4%)
V2 Wind turbine	+ 15.1	-£ 684	-1856 kg (110.2%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£66	1.74 kg/m ²	D 66 C 76
Solar photovoltaic panels	£371	7.29 kg/m ²	C 73 B 83
Wind turbine	£684	13.45 kg/m ²	B 88 A 96
Total Savings	£1120	22.49 kg/m²	

Potential energy efficiency rating: B 88
 Potential environmental impact rating: A 96

Fuel prices for cost data on this page from database revision number 482 TEST (31 Aug 2021)
 Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£113	£123	-£10
Bulk LPG	£806	£730	£75
Space heating	£644	£644	£0
Water heating	£176	£111	£66
Lighting	£99	£99	£0
Generated (PV)	-£0	-£371	£371
Generated (wind)	-£0	-£684	£684
Total cost of fuels	£919	-£202	£1120
Total cost of uses	£919	-£201	£1121
Delivered energy	83 kWh/m ²	36 kWh/m ²	48 kWh/m ²
Carbon dioxide emissions	2.9 tonnes	-0.2 tonnes	3.1 tonnes
CO2 emissions per m ²	21 kg/m ²	-1 kg/m ²	22 kg/m ²
Primary energy	99 kWh/m ²	-31 kWh/m ²	130 kWh/m ²

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.9800 (1b)	x 2.4000 (2b)	= 165.5520 (1b) - (3b)
First floor	68.9800 (1c)	x 2.9900 (2c)	= 206.2502 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.9600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 371.8022 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1345 (8)
Pressure test					No
Measured/design AP50					15.0000
Infiltration rate					0.8845 (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) = 0.7518 (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												
Effective ac	0.9586	0.9398	0.9210	0.8270	0.8082	0.7142	0.7142	0.6954	0.7518	0.8082	0.8458	0.8834 (22b)
	0.9594	0.9416	0.9241	0.8420	0.8266	0.7551	0.7551	0.7418	0.7826	0.8266	0.8577	0.8902 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 window (Uw = 1.60)			16.4000	1.5038	24.6617		(27)
Opening Type 2 door			1.8000	1.6000	2.8800		(26)
Opening Type 3 velux (Uw = 1.30)			2.6900	1.2357	3.3241		(27a)
Heat Loss Floor 1			68.9800	0.1000	6.8980	78.0000	5380.4400 (28a)
External Wall 1 cavity	39.9600	10.6000	29.3600	0.2800	8.2208	41.6000	1221.3760 (29a)
External Wall 2 timber frame	48.1200	7.6000	40.5200	0.1600	6.4832	20.3200	823.3664 (29a)
External Roof 1	45.3400	2.6900	42.6500	0.1500	6.3975	9.0000	383.8500 (30)
External Roof 2	50.2400		50.2400	0.1600	8.0384	15.7000	788.7680 (30)
Total net area of external elements Aum(A, m ²)			252.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.9037		(33)
Party Wall 1			88.0800	0.0000	0.0000	70.0000	6165.6000 (32)
Internal Wall 1			89.5200			75.0000	6714.0000 (32c)
Internal Wall 2			130.6200			9.0000	1175.5800 (32c)
Internal Floor 1			68.9800			18.0000	1241.6400 (32d)
Internal Ceiling 1			68.9800			18.0000	1241.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25136.2604 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.1996 (35)
Thermal bridges (Default value 0.150 * total exposed area)							37.8960 (36)
Total fabric heat loss						(33) + (36) =	104.7997 (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	117.7151	115.5262	113.3807	103.3035	101.4181	92.6411	92.6411	91.0157	96.0218	101.4181	105.2322	109.2198 (38)
Heat transfer coeff	222.5148	220.3259	218.1804	208.1032	206.2178	197.4408	197.4408	195.8154	200.8215	206.2178	210.0319	214.0195 (39)
Average = Sum(39)m / 12 =												208.0941 (39)
HLP	1.6129	1.5970	1.5815	1.5084	1.4948	1.4311	1.4311	1.4194	1.4557	1.4948	1.5224	1.5513 (40)
HLP (average)												1.5084 (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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average daily hot water use (litres/day)												2.9131 (42)
Daily hot water use												103.3861 (43)

FULL SAP CALCULATION PRINTOUT

Calculation Type: Conversion (As Built)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy conte	113.7247	109.5893	105.4538	101.3184	97.1829	93.0475	93.0475	97.1829	101.3184	105.4538	109.5893	113.7247 (44)	
Energy content (annual)	168.6504	147.5027	152.2096	132.7000	127.3288	109.8751	101.8154	116.8347	118.2301	137.7858	150.4039	163.3289 (45)	
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m =	1626.6657 (45)
	25.2976	22.1254	22.8314	19.9050	19.0993	16.4813	15.2723	17.5252	17.7345	20.6679	22.5606	24.4993 (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	50.9589	46.0274	50.9589	49.3151	49.5234	45.8864	47.4160	49.5234	49.3151	50.9589	49.3151	50.9589 (61)	
Total heat required for water heating calculated for each month	219.6093	193.5301	203.1685	182.0151	176.8522	155.7615	149.2314	166.3581	167.5452	188.7447	199.7190	214.2878 (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												1.1149 (H8)	
Utilisation factor												0.5922 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												103.3861 (H14)	
Volume ratio Veff/V												0.7254 (H15)	
Solar storage volume factor												0.9358 (H16)	
Solar input	-25.6260	-42.7625	-72.8294	-97.6057	-120.5836	-118.5529	-116.9862	-102.2114	-80.0520	-54.6661	-30.3961	-883.7166 (H17)	
Solar input (sum of months) = Sum(63)m =												-883.7166 (63)	
Output from w/h	193.9833	150.7677	130.3392	84.4094	56.2686	37.2086	32.2452	64.1466	87.4931	134.0786	169.3229	192.8432 (64)	
Total per year (kWh/year) = Sum(64)m =												1333.1065 (64)	
Heat gains from water heating, kWh/month	68.8160	60.5515	63.3494	56.4515	54.7177	48.0051	45.7076	51.2284	51.6403	58.5535	62.3381	67.0466 (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	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.1583	64.9785	52.8441	40.0064	29.9052	25.2473	27.2806	35.4603	47.5947	60.4325	70.5336	75.1916 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	458.3290	463.0850	451.1000	425.5853	393.3776	363.1069	342.8842	338.1282	350.1132	375.6279	407.8356	438.1063 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917 (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)	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239 (71)
Water heating gains (Table 5)	92.4946	90.1064	85.1471	78.4049	73.5453	66.6737	61.4350	68.8553	71.7226	78.7009	86.5807	90.1164 (72)
Total internal gains	740.6356	734.8236	705.7448	660.6503	613.4818	571.6815	548.2534	559.0975	586.0842	631.4149	681.6035	720.0679 (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
Northeast	12.8000	11.2829	0.7600	0.7000	0.7700	53.2448 (75)
Northwest	3.6000	11.2829	0.7600	0.7000	0.7700	14.9751 (81)
Northwest	2.6900	26.0000	0.7600	0.7000	1.0000	33.4873 (82)

Solar gains	101.7072	208.4141	373.8333	604.0763	799.5947	846.4090	794.2507	641.3349	452.9748	254.7084	128.3414	82.7592 (83)
Total gains	842.3427	943.2377	1079.5781	1264.7266	1413.0765	1418.0905	1342.5041	1200.4324	1039.0590	886.1234	809.9449	802.8271 (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	31.3790	31.6908	32.0024	33.5521	33.8588	35.3640	35.3640	35.6575	34.7687	33.8588	33.2440	32.6246
alpha	3.0919	3.1127	3.1335	3.2368	3.2573	3.3576	3.3576	3.3772	3.3179	3.2573	3.2163	3.1750
util living area	0.9921	0.9881	0.9771	0.9434	0.8662	0.7242	0.5848	0.6511	0.8647	0.9662	0.9883	0.9933 (86)
MIT	20.1753	20.2272	20.3269	20.4853	20.6126	20.7110	20.7421	20.7361	20.6577	20.4933	20.3261	20.1909 (87)
Th 2	19.6039	19.6155	19.6269	19.6812	19.6914	19.7395	19.7395	19.7485	19.7209	19.6914	19.6707	19.6492 (88)
util rest of house	0.9899	0.9847	0.9702	0.9252	0.8202	0.6294	0.4425	0.5116	0.7992	0.9521	0.9844	0.9915 (89)
MIT 2	18.8396	18.9019	19.0114	19.2167	19.3451	19.4737	19.4934	19.5005	19.4168	19.2364	19.0519	18.8972 (90)
Living area fraction	19.1097	19.1698	19.2773	19.4732	19.6014	19.7239	19.7458	19.7503	19.6677	19.4905	19.3095	19.1587 (91)
MIT	19.1097	19.1698	19.2773	19.4732	19.6014	19.7239	19.7458	19.7503	19.6677	19.4905	19.3095	19.1587 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1097	19.1698	19.2773	19.4732	19.6014	19.7239	19.7458	19.7503	19.6677	19.4905	19.3095	19.1587 (93)

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9890	0.9834	0.9680	0.9217	0.8164	0.6280	0.4433	0.5118	0.7957	0.9493	0.9831	0.9907	(94)
Useful gains	833.0698	927.5605	1045.0463	1165.6681	1153.6486	890.5674	595.1162	614.4186	826.8197	841.2156	796.2310	795.3575	(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													
	3295.3661	3144.0173	2787.7644	2200.3118	1629.4040	1011.6586	621.1088	656.0386	1118.1062	1833.3773	2564.3889	3201.4610	(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													
	1831.9485	1489.4590	1296.5823	744.9434	353.9620	0.0000	0.0000	0.0000	0.0000	738.1683	1273.0737	1790.1410	(98)
Space heating													
Space heating per m2													(98) / (4) = 68.9930 (99)

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													10517.4345 (211)
Space heating requirement	1831.9485	1489.4590	1296.5823	744.9434	353.9620	0.0000	0.0000	0.0000	0.0000	738.1683	1273.0737	1790.1410	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	2024.2525	1645.8110	1432.6877	823.1419	391.1182	0.0000	0.0000	0.0000	0.0000	815.6555	1406.7113	1978.0564	(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	193.9833	150.7677	130.3392	84.4094	56.2686	37.2086	32.2452	64.1466	87.4931	134.0786	169.3229	192.8432	(64)
Efficiency of water heater (217)m	89.4244	89.4669	89.4733	89.3575	88.9670	80.4000	80.4000	80.4000	80.4000	88.7855	89.1848	89.4077	(216)
Fuel for water heating, kWh/month	216.9244	168.5178	145.6738	94.4626	63.2466	46.2794	40.1060	79.7844	108.8223	151.0140	189.8562	215.6896	(219)
Water heating fuel used													1520.3770 (219)
Annual totals kWh/year													
Space heating fuel - main system													10517.4345 (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)													516.7992 (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)
Wind generation													-3575.5408 (234)
Total delivered energy for all uses													7376.8306 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	10517.4345	7.6000	799.3250	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1520.3770	7.6000	115.5487	(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	516.7992	13.1900	68.1658	(250)
Additional standing charges			70.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Wind Turbine	-3575.5408	13.1900	-471.6138	(252)
Total energy cost			370.0903	(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] =	0.8496	(257)
SAP value		88.1485	
SAP rating (Section 12)		88	(258)
SAP band		B	

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 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	10517.4345	0.2410	2534.7017	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1520.3770	0.2410	366.4109	(264)
Space and water heating			2901.1126	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	516.7992	0.5190	268.2188	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Wind Turbine	-3575.5408	0.5190	-1855.7056	(269)
Total kg/year			482.0635	(272)
CO2 emissions per m2			3.4900	(273)
EI value			96.4694	
EI rating			96	(274)
EI band			A	

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 (m ²)	Storey height (m)	Volume (m ³)
Ground floor	68.9800 (1b)	x 2.4000 (2b)	= 165.5520 (1b) - (3b)
First floor	68.9800 (1c)	x 2.9900 (2c)	= 206.2502 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	137.9600		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 371.8022 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour							
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)							
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)							
Number of intermittent fans					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) = 0.1345 (8)							
Pressure test					No							
Measured/design AP50					15.0000							
Infiltration rate					0.8845 (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) = 0.7518 (21)							
Wind speed	Jan 4.5000	Feb 4.2000	Mar 4.3000	Apr 4.0000	May 4.1000	Jun 3.7000	Jul 3.9000	Aug 3.6000	Sep 3.6000	Oct 3.9000	Nov 3.9000	Dec 4.2000 (22)
Wind factor	1.1250	1.0500	1.0750	1.0000	1.0250	0.9250	0.9750	0.9000	0.9000	0.9750	0.9750	1.0500 (22a)
Adj infilt rate	0.8458	0.7894	0.8082	0.7518	0.7706	0.6954	0.7330	0.6766	0.6766	0.7330	0.7330	0.7894 (22b)
Effective ac	0.8577	0.8116	0.8266	0.7826	0.7969	0.7418	0.7687	0.7289	0.7289	0.7687	0.7687	0.8116 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1 window (Uw = 1.60)			16.4000	1.5038	24.6617		(27)
Opening Type 2 door			1.8000	1.6000	2.8800		(26)
Opening Type 3 velux (Uw = 1.30)			2.6900	1.2357	3.3241		(27a)
Heat Loss Floor 1			68.9800	0.1000	6.8980	78.0000	5380.4400 (28a)
External Wall 1 cavity	39.9600	10.6000	29.3600	0.2800	8.2208	41.6000	1221.3760 (29a)
External Wall 2 timber frame	48.1200	7.6000	40.5200	0.1600	6.4832	20.3200	823.3664 (29a)
External Roof 1	45.3400	2.6900	42.6500	0.1500	6.3975	9.0000	383.8500 (30)
External Roof 2	50.2400		50.2400	0.1600	8.0384	15.7000	788.7680 (30)
Total net area of external elements Aum(A, m ²)			252.6400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	66.9037		(33)
Party Wall 1			88.0800	0.0000	0.0000	70.0000	6165.6000 (32)
Internal Wall 1			89.5200			75.0000	6714.0000 (32c)
Internal Wall 2			130.6200			9.0000	1175.5800 (32c)
Internal Floor 1			68.9800			18.0000	1241.6400 (32d)
Internal Ceiling 1			68.9800			18.0000	1241.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	25136.2604 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							182.1996 (35)
Thermal bridges (Default value 0.150 * total exposed area)							37.8960 (36)
Total fabric heat loss						(33) + (36) =	104.7997 (37)

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

(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	105.2322	99.5760	101.4181	96.0218	97.7772	91.0157	94.3098	89.4337	89.4337	94.3098	94.3098	99.5760 (38)
Average = Sum(39)m / 12 =	210.0319	204.3757	206.2178	200.8215	202.5769	195.8154	199.1095	194.2334	194.2334	199.1095	199.1095	204.3757 (39)
HLP	1.5224	1.4814	1.4948	1.4557	1.4684	1.4194	1.4432	1.4079	1.4079	1.4432	1.4432	1.4814 (40)
HLP (average)												1.4557 (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												2.9131 (42)
Average daily hot water use (litres/day)												103.3861 (43)
Daily hot water use												

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Energy conte	113.7247	109.5893	105.4538	101.3184	97.1829	93.0475	93.0475	97.1829	101.3184	105.4538	109.5893	113.7247 (44)
Energy content (annual)	168.6504	147.5027	152.2096	132.7000	127.3288	109.8751	101.8154	116.8347	118.2301	137.7858	150.4039	163.3289 (45)
Distribution loss (46)m = 0.15 x (45)m												Total = Sum(45)m = 1626.6657 (45)
Water storage loss:	25.2976	22.1254	22.8314	19.9050	19.0993	16.4813	15.2723	17.5252	17.7345	20.6679	22.5606	24.4993 (46)
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.9589	49.3151	49.5234	45.8864	47.4160	49.5234	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	219.6093	193.5301	203.1685	182.0151	176.8522	155.7615	149.2314	166.3581	167.5452	188.7447	199.7190	214.2878 (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												1211.9476 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												2036.0720 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2517 (H8)
Utilisation factor												0.5502 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												103.3861 (H14)
Volume ratio Veff/V												0.7254 (H15)
Solar storage volume factor												0.9358 (H16)
Solar input	-29.2702	-42.8606	-72.9060	-101.5450	-119.2491	-127.5179	-121.0887	-107.7800	-84.7858	-56.8788	-34.0049	-921.7688 (H17)
Solar input (sum of months) = Sum(63)m =												-23.8819 (63)
Output from w/h	190.3392	150.6696	130.2625	80.4701	57.6031	28.2437	28.1428	58.5780	82.7594	131.8659	165.7141	190.4059 (64)
Total per year (kWh/year) = Sum(64)m =												1295.0542 (64)
Heat gains from water heating, kWh/month	68.8160	60.5515	63.3494	56.4515	54.7177	48.0051	45.7076	51.2284	51.6403	58.5535	62.3381	67.0466 (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	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859	174.7859 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	73.1583	64.9785	52.8441	40.0064	29.9052	25.2473	27.2806	35.4603	47.5947	60.4325	70.5336	75.1916 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	458.3290	463.0850	451.1000	425.5853	393.3776	363.1069	342.8842	338.1282	350.1132	375.6279	407.8356	438.1063 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917	55.3917 (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)	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239	-116.5239 (71)
Water heating gains (Table 5)	92.4946	90.1064	85.1471	78.4049	73.5453	66.6737	61.4350	68.8553	71.7226	78.7009	86.5807	90.1164 (72)
Total internal gains	740.6356	734.8236	705.7448	660.6503	613.4818	571.6815	548.2534	559.0975	586.0842	631.4149	681.6035	720.0679 (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						
Northeast	12.8000	14.2063	0.7600	0.7000	0.7700	67.0401 (75)						
Northwest	3.6000	14.2063	0.7600	0.7000	0.7700	18.8550 (81)						
Northwest	2.6900	33.0000	0.7600	0.7000	1.0000	42.5031 (82)						
Solar gains	128.3982	231.4341	414.7018	693.8804	868.9177	997.8294	902.0852	745.2476	531.0893	293.7729	158.8287	101.7663 (83)
Total gains	869.0337	966.2577	1120.4467	1354.5307	1482.3995	1569.5110	1450.3386	1304.3451	1117.1735	925.1879	840.4322	821.8342 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation factor for gains for living area, nil,m (see Table 9a)												21.0000 (85)
tau	33.2440	34.1640	33.8588	34.7687	34.4674	35.6575	35.0676	35.9480	35.9480	35.0676	35.0676	34.1640
alpha	3.2163	3.2776	3.2573	3.3179	3.2978	3.3772	3.3378	3.3965	3.3965	3.3378	3.3378	3.2776
util living area	0.9895	0.9843	0.9679	0.9167	0.8131	0.6033	0.4914	0.5157	0.7886	0.9481	0.9826	0.9911 (86)
MIT	20.2710	20.3279	20.4150	20.5524	20.6588	20.7379	20.7488	20.7524	20.7036	20.5600	20.4163	20.2799 (87)
Th 2	19.6707	19.7015	19.6914	19.7209	19.7113	19.7485	19.7303	19.7573	19.7573	19.7303	19.7303	19.7015 (88)
util rest of house	0.9864	0.9798	0.9579	0.8903	0.7507	0.4890	0.3407	0.3582	0.6945	0.9252	0.9764	0.9885 (89)
MIT 2	18.9969	19.0819	19.1583	19.3181	19.4040	19.4998	19.4860	19.5170	19.4888	19.3373	19.1969	19.0343 (90)
Living area fraction	19.2544	19.3338	19.4124	19.5676	19.6577	19.7501	19.7413	19.7668	19.7344	19.5845	19.4434	19.2861 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2544	19.3338	19.4124	19.5676	19.6577	19.7501	19.7413	19.7668	19.7344	19.5845	19.4434	19.2861 (93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9852	0.9782	0.9553	0.8865	0.7476	0.4891	0.3421	0.3595	0.6924	0.9218	0.9747	0.9874	(94)
Useful gains	856.1963	945.1595	1070.3919	1200.7483	1108.2552	767.6940	496.0938	468.9001	773.5488	852.8412	819.1557	811.5197	(95)
Ext temp.	5.5000	6.0000	7.6000	9.8000	12.7000	15.6000	17.2000	17.3000	15.0000	11.7000	8.4000	5.5000	(96)
Heat loss rate W	2888.8711	2725.1023	2435.9264	1961.5484	1409.4696	812.6536	505.9994	479.1254	919.5745	1569.8760	2198.8425	2817.5467	(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	1512.3101	1196.1215	1015.9576	547.7761	224.1035	0.0000	0.0000	0.0000	0.0000	533.4738	993.3745	1492.4841	(98)
Space heating per m2													(98) / (4) = 54.4767 (99)

8c. Space cooling requirement

Not applicable

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													8304.5318 (211)
Space heating requirement	1512.3101	1196.1215	1015.9576	547.7761	224.1035	0.0000	0.0000	0.0000	0.0000	533.4738	993.3745	1492.4841	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	1671.0608	1321.6813	1122.6051	605.2775	247.6282	0.0000	0.0000	0.0000	0.0000	589.4739	1097.6514	1649.1537	(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	190.3392	150.6696	130.2625	80.4701	57.6031	28.2437	28.1428	58.5780	82.7594	131.8659	165.7141	190.4059	(64)
Efficiency of water heater (217)m	89.2467	89.2458	89.2262	89.0669	88.2335	80.4000	80.4000	80.4000	80.4000	88.3015	88.9033	89.2317	(217)
Fuel for water heating, kWh/month	213.2731	168.8254	145.9913	90.3480	65.2848	35.1290	35.0034	72.8582	102.9346	149.3359	186.3982	213.3837	(219)
Water heating fuel used													1478.7656 (219)
Annual totals kWh/year													
Space heating fuel - main system													8304.5318 (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)													516.7992 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1212 * 0.80) =													-1939.1161 (233)
Wind generation													-3575.5408 (234)
Total delivered energy for all uses													4910.4397 (238)

10a. Fuel costs - using BEDF prices (482)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	8304.5318	6.8300	567.1995	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1478.7656	6.8300	100.9997	(247)
Pumps and fans for heating	75.0000	19.1200	14.3400	(249)
Pump for solar water heating	50.0000	19.1200	9.5600	(249)
Energy for lighting	516.7992	19.1200	98.8120	(250)
Additional standing charges			62.0000	(251)
Energy saving/generation technologies				
PV Unit	-1939.1161	19.1200	-370.7590	(252)
Wind Turbine	-3575.5408	19.1200	-683.6434	(252)
Total energy cost			-201.4912	(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	8304.5318	0.2410	2001.3922	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1478.7656	0.2410	356.3825	(264)
Space and water heating			2357.7747	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)

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Energy for lighting	516.7992	0.5190	268.2188 (268)
Energy saving/generation technologies			
PV Unit	-1939.1161	0.5190	-1006.4013 (269)
Wind Turbine	-3575.5408	0.5190	-1855.7056 (269)
Total kg/year			-171.2385 (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	8304.5318	1.0900	9051.9396 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1478.7656	1.0900	1611.8545 (264)
Space and water heating			10663.7941 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	516.7992	3.0700	1586.5737 (268)
Energy saving/generation technologies			
PV Unit	-1939.1161	3.0700	-5953.0866 (269)
Wind Turbine	-3575.5408	3.0700	-10976.9101 (269)
Primary energy kWh/year			-4295.8789 (272)
Primary energy kWh/m2/year			-31.1386 (273)

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Property Reference	200047			Issued on Date	28/09/2021
Assessment Reference	001	Prop Type Ref	3 Brinsea Batch BS49 5JP		
Property	Fernley House, Brinsea, Congresbury, BRISTOL, BS49 5JP				
SAP Rating	63 D	DER	N/A	TER	N/A
Environmental	75 C	% DER<TER	N/A		
CO₂ Emissions (t/year)	2.93	DFEE	N/A	TFEE	N/A
General Requirements Compliance	N/A	% DFEE<TFEE	N/A		
Assessor Details	Mr. Michael Heinemans, DEA 4 U, Tel: 01275 878257, mhmb@yahoo.co.uk			Assessor ID	D395-0001
Client					