

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



Property and Energy
Services Ltd.

Property Reference	3260-2	Issued on Date	10/05/2019
Assessment Reference	3260-2	Prop Type Ref	
Property	2, Aldworth Rise, READING, RG1 7NA		

SAP Rating	84 B	DER	16.94	TER	17.17
Environmental	87 B	% DER<TER	1.33		
CO ₂ Emissions (t/year)	1.13	DFEE	39.09	TFEE	49.08
General Requirements Compliance	Pass	% DFEE<TFEE	20.36		

Assessor Details	Mr. Ian Lloyd, Property and Energy Services Limited, Tel: 01367240212, ianl@propertyandenergy.co.uk	Assessor ID	H044-0001
Client	Keen Partnership, Keen		

CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (5)

2. Ventilation rate

	main heating		+	secondary heating	+	other	=	total	m3 per hour			
Number of chimneys		0		0		0	=	0 * 40 =	0.0000 (6a)			
Number of open flues		0		0		0	=	0 * 20 =	0.0000 (6b)			
Number of intermittent fans								4 * 10 =	40.0000 (7a)			
Number of passive vents								0 * 10 =	0.0000 (7b)			
Number of flueless gas fires								0 * 40 =	0.0000 (7c)			
									Air changes per hour			
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =							40.0000 / (5) =	0.1988 (8)			
Pressure test								Yes				
Measured/design AP50									4.8800			
Infiltration rate									0.4428 (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) =	0.3764 (21)			
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.4046	0.3858	0.3858	0.3576	0.3670	0.3199	0.3199	0.3105	0.3199	0.3576	0.3482	0.3764 (22b)
Effective ac	0.5819	0.5744	0.5744	0.5639	0.5673	0.5512	0.5512	0.5482	0.5512	0.5639	0.5606	0.5708 (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					
Door -1			2.5500	1.0000	2.5500			(26)				
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727			(27)				
Velux (Uw = 1.50)			1.0600	1.4151	1.5000			(27a)				
Ground floor			45.2400	0.0900	4.0716			(28a)				
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836			(29a)				
Ceiling	16.8100		16.8100	0.1100	1.8491			(30)				
Skelling	31.5900	1.0600	30.5300	0.1600	4.8848			(30)				
Total net area of external elements Aum(A, m2)			138.3700					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7118			(33)				
Party Wall			99.8900	0.0000	0.0000			(32)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								5.4007 (36)				
Total fabric heat loss								(33) + (36) = 48.1125 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 38.6294	Feb 38.1356	Mar 38.1356	Apr 37.4390	May 37.6653	Jun 36.5924	Jul 36.5924	Aug 36.3955	Sep 36.5924	Oct 37.4390	Nov 37.2185	Dec 37.8975 (38)

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Heat transfer coeff	86.7419	86.2481	86.2481	85.5514	85.7778	84.7049	84.7049	84.5080	84.7049	85.5514	85.3310	86.0100 (39)
Average = Sum(39)m / 12 =												85.5069 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0682	1.0622	1.0622	1.0536	1.0564	1.0432	1.0432	1.0407	1.0432	1.0536	1.0509	1.0592 (40)
Days in month												1.0530 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4852 (42)
Average daily hot water use (litres/day)												93.2243 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Energy content (annual)										Total = Sum(45)m =		1466.7819 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)
Water storage loss:												
Store volume												180.0000 (47)
a) IF manufacturer declared loss factor is known (kWh/day):												1.5300 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8262 (55)
Total storage loss												
	25.6122	23.1336	25.6122	24.7860	25.6122	24.7860	25.6122	25.6122	24.7860	25.6122	24.7860	25.6122 (56)
If cylinder contains dedicated solar storage												
	25.6122	23.1336	25.6122	24.7860	25.6122	24.7860	25.6122	25.6122	24.7860	25.6122	24.7860	25.6122 (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												
	200.9485	177.1496	186.1237	166.9551	163.6884	146.3736	140.6827	154.2257	153.9073	173.1175	182.9188	196.1501 (62)
Solar input	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												
	200.9485	177.1496	186.1237	166.9551	163.6884	146.3736	140.6827	154.2257	153.9073	173.1175	182.9188	196.1501 (64)
								Total per year (kWh/year) = Sum(64)m =				2042.2409 (64)
												2042 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
	89.6643	79.5399	84.7350	77.6244	77.2753	70.7810	69.6259	74.1289	73.2860	80.4104	82.9323	88.0688 (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	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	49.4646	43.9340	35.7295	27.0496	20.2199	17.0705	18.4452	23.9758	32.1803	40.8603	47.6900	50.8394 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	331.2391	334.6764	326.0147	307.5749	284.2981	262.4211	247.8060	244.3688	253.0305	271.4702	294.7470	316.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966 (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)												
	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094 (71)
Water heating gains (Table 5)												
	120.5165	118.3630	113.8911	107.8116	103.8646	98.3070	93.5832	99.6357	101.7861	108.0786	115.1838	118.3720 (72)
Total internal gains												
	606.3216	602.0747	580.7367	547.5375	513.4839	482.8999	464.9357	473.0816	492.0982	525.5104	562.7222	590.9367 (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
East					8.4100	23.8018		0.6300	0.7000	0.7700		61.1754 (76)
West					8.3900	23.8018		0.6300	0.7000	0.7700		61.0299 (80)
North					1.0600	19.2832		0.6300	0.7000	1.0000		8.1127 (82)

Solar gains	130.3181	222.5340	366.1629	550.4535	667.3517	728.0986	684.0705	594.6496	456.3732	283.7923	159.9441	107.9159 (83)
Total gains	736.6397	824.6088	946.8995	1097.9909	1180.8356	1210.9985	1149.0062	1067.7312	948.4714	809.3027	722.6663	698.8526 (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	65.0077	65.3799	65.3799	65.9123	65.7384	66.5710	66.5710	66.7261	66.5710	65.9123	66.0826	65.5609
alpha	5.3338	5.3587	5.3587	5.3942	5.3826	5.4381	5.4381	5.4484	5.4381	5.3942	5.4055	5.3707
util living area												
	0.9833	0.9682	0.9177	0.7766	0.5740	0.3628	0.2432	0.2689	0.5273	0.8454	0.9633	0.9865 (86)
MIT	20.3724	20.4898	20.6813	20.8640	20.9345	20.9490	20.9500	20.9500	20.9429	20.8361	20.5847	20.3513 (87)
Th 2	20.0268	20.0318	20.0318	20.0389	20.0366	20.0475	20.0475	20.0495	20.0475	20.0389	20.0412	20.0343 (88)
util rest of house												

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MIT 2	0.9781	0.9588	0.8954	0.7302	0.5110	0.2968	0.1730	0.1939	0.4475	0.7974	0.9505	0.9823 (89)
Living area fraction	19.2116	19.3825	19.6457	19.8803	19.9514	19.9739	19.9743	19.9765	19.9703	19.8550	19.5269	19.1876 (90)
MIT	19.4512	19.6110	19.8594	20.0834	20.1543	20.1752	20.1757	20.1774	20.1711	20.0575	19.7452	19.4278 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.3012	19.4610	19.7094	19.9334	20.0043	20.0252	20.0257	20.0274	20.0211	19.9075	19.5952	19.2778 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9731	0.9519	0.8867	0.7247	0.5089	0.2953	0.1714	0.1921	0.4452	0.7899	0.9431	0.9779 (94)	
Useful gains	716.8017	784.9343	839.6181	795.7576	600.8884	357.5595	196.9876	205.1141	422.2991	639.2933	681.5119	683.4028 (95)	
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000 (96)	
Heat loss rate W	1231.8394	1186.8627	1061.6637	858.3679	609.3946	357.8928	196.9987	205.1348	425.3095	719.2745	989.4339	1219.4332 (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	383.1881	270.0958	165.2019	45.0794	6.3287	0.0000	0.0000	0.0000	0.0000	59.5060	221.7039	398.8066 (98)	
Space heating												1549.9104 (98)	
RHI space heating demand												1550 (98)	

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					4.8800
Infiltration rate					0.4428 (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) =		0.3764 (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	0.4799	0.4705	0.4611	0.4140	0.4046	0.3576	0.3576	0.3482	0.3764	0.4046	0.4235	0.4423 (22b)
Effective ac	0.6152	0.6107	0.6063	0.5857	0.5819	0.5639	0.5639	0.5606	0.5708	0.5819	0.5897	0.5978 (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
Door -1			2.5500	1.0000	2.5500		(26)
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)
Velux (Uw = 1.50)			1.0600	1.4151	1.5000		(27a)
Ground floor			45.2400	0.0900	4.0716		(28a)
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)
Ceiling	16.8100		16.8100	0.1100	1.8491		(30)
Skelling	31.5900	1.0600	30.5300	0.1600	4.8848		(30)
Total net area of external elements Aum(A, m ²)			138.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7118		(33)
Party Wall			99.8900	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4007 (36)
Total fabric heat loss						(33) + (36) =	48.1125 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.8398	40.5429	40.2519	38.8851	38.6294	37.4390	37.4390	37.2185	37.8975	38.6294	39.1467	39.6876 (38)
Heat transfer coeff	88.9523	88.6554	88.3644	86.9976	86.7419	85.5514	85.5514	85.3310	86.0100	86.7419	87.2592	87.8000 (39)
Average = Sum(39)m / 12 =												86.9964 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0955	1.0918	1.0882	1.0714	1.0682	1.0536	1.0536	1.0509	1.0592	1.0682	1.0746	1.0813 (40)
HLP (average)												1.0714 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4852 (42)
Average daily hot water use (litres/day)												93.2243 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Energy content (annual)												Total = Sum(45)m = 1466.7819 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)
Water storage loss:												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.10R08



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

store volume													180.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5300	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8262	(55)
Total storage loss														
	25.6122	23.1336	25.6122	24.7860	25.6122	24.7860	25.6122	25.6122	24.7860	25.6122	24.7860	25.6122	(56)	
If cylinder contains dedicated solar storage														
	25.6122	23.1336	25.6122	24.7860	25.6122	24.7860	25.6122	25.6122	24.7860	25.6122	24.7860	25.6122	(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														
	200.9485	177.1496	186.1237	166.9551	163.6884	146.3736	140.6827	154.2257	153.9073	173.1175	182.9188	196.1501	(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)	
													(63)	
Output from w/h														
	200.9485	177.1496	186.1237	166.9551	163.6884	146.3736	140.6827	154.2257	153.9073	173.1175	182.9188	196.1501	(64)	
													(64)	
Heat gains from water heating, kWh/month														
	89.6643	79.5399	84.7350	77.6244	77.2753	70.7810	69.6259	74.1289	73.2860	80.4104	82.9323	88.0688	(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	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.4646	43.9340	35.7295	27.0496	20.2199	17.0705	18.4452	23.9758	32.1803	40.8603	47.6900	50.8394 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.2391	334.6764	326.0147	307.5749	284.2981	262.4211	247.8060	244.3688	253.0305	271.4702	294.7470	316.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966 (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)	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094 (71)
Water heating gains (Table 5)	120.5165	118.3630	113.8911	107.8116	103.8646	98.3070	93.5832	99.6357	101.7861	108.0786	115.1838	118.3720 (72)
Total internal gains	606.3216	602.0747	580.7367	547.5375	513.4839	482.8999	464.9357	473.0816	492.0982	525.5104	562.7222	590.9367 (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
East	8.4100	19.6403	0.6300	0.7000	0.7700	50.4795 (76)
West	8.3900	19.6403	0.6300	0.7000	0.7700	50.3595 (80)
North	1.0600	16.1759	0.6300	0.7000	1.0000	6.8054 (82)

Solar gains	107.6444	210.1509	348.2985	516.4050	643.5571	664.2710	630.1133	533.5471	407.3892	249.6494	134.0646	88.6642 (83)
Total gains	713.9660	812.2257	929.0352	1063.9425	1157.0410	1147.1709	1095.0491	1006.6287	899.4875	775.1597	696.7868	679.6010 (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	63.3923	63.6046	63.8140	64.8166	65.0077	65.9123	65.9123	66.0826	65.5609	65.0077	64.6223	64.2242
alpha	5.2262	5.2403	5.2543	5.3211	5.3338	5.3942	5.3942	5.4055	5.3707	5.3338	5.3082	5.2816
util living area												
	0.9886	0.9769	0.9414	0.8373	0.6629	0.4726	0.3430	0.3885	0.6339	0.8985	0.9769	0.9909 (86)
MIT	20.2649	20.3924	20.5915	20.8065	20.9141	20.9449	20.9490	20.9484	20.9289	20.7680	20.4807	20.2444 (87)
Th 2	20.0045	20.0075	20.0105	20.0243	20.0268	20.0389	20.0389	20.0412	20.0343	20.0268	20.0216	20.0161 (88)
util rest of house												
	0.9851	0.9701	0.9250	0.7994	0.6042	0.4038	0.2685	0.3083	0.5554	0.8637	0.9688	0.9881 (89)
MIT 2	19.0384	19.2235	19.5049	19.7983	19.9224	19.9624	19.9649	19.9671	19.9462	19.7612	19.3638	19.0182 (90)
Living area fraction												
									fLA = Living area / (4) =			0.2064 (91)
MIT	19.2915	19.4648	19.7292	20.0064	20.1271	20.1652	20.1680	20.1696	20.1490	19.9690	19.5943	19.2713 (92)
Temperature adjustment												-0.1500
adjusted MIT	19.1415	19.3148	19.5792	19.8564	19.9771	20.0152	20.0180	20.0196	19.9990	19.8190	19.4443	19.1213 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9811	0.9640	0.9164	0.7922	0.6011	0.4020	0.2669	0.3065	0.5524	0.8549	0.9626	0.9847 (94)
Useful gains	700.4742	782.9658	851.3461	842.8057	695.5024	461.1961	292.2446	308.5054	496.8879	662.7042	670.7498	669.2206 (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	1320.1876	1277.9460	1155.7360	953.1828	717.9707	463.2776	292.4176	308.8662	507.3760	799.6709	1077.1572	1310.0899 (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	461.0668	332.6267	226.4661	79.4715	16.7164	0.0000	0.0000	0.0000	0.0000	101.9032	292.6134	476.8068 (98)
Space heating												1987.6708 (99)
Space heating per m2										(98) / (4) =		24.4787 (99)

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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 %)													89.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2213.4419 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	461.0668	332.6267	226.4661	79.4715	16.7164	0.0000	0.0000	0.0000	0.0000	101.9032	292.6134	476.8068	(98)
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000	(210)
Space heating fuel (main heating system)	513.4374	370.4084	252.1894	88.4984	18.6151	0.0000	0.0000	0.0000	0.0000	113.4780	325.8501	530.9652	(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	200.9485	177.1496	186.1237	166.9551	163.6884	146.3736	140.6827	154.2257	153.9073	173.1175	182.9188	196.1501	(64)
Efficiency of water heater (217)m	86.2582	85.7682	84.6353	82.2610	79.9831	79.1000	79.1000	79.1000	79.1000	82.7536	85.3585	86.3936	(216)
Fuel for water heating, kWh/month	232.9616	206.5445	219.9125	202.9577	204.6538	185.0488	177.8542	194.9756	194.5731	209.1964	214.2949	227.0422	(219)
Water heating fuel used												2470.0154	(219)
Annual totals kWh/year													
Space heating fuel - main system												2213.4419	(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)												349.4241	(232)
Total delivered energy for all uses												5107.8814	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2213.4419	3.4800	77.0278 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2470.0154	3.4800	85.9565 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	349.4241	13.1900	46.0890 (250)
Additional standing charges			120.0000 (251)
Total energy cost			338.9659 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1281 (257)
SAP value		84.2631
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2213.4419	0.2160	478.1034 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2470.0154	0.2160	533.5233 (264)
Space and water heating			1011.6268 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	349.4241	0.5190	181.3511 (268)
Total kg/year			1231.9029 (272)
CO2 emissions per m2			15.1700 (273)
EI value			86.9196
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.8980 = 4.156$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.8980 = 0.2580$, stars = 4
Water heating energy efficiency	$3.48 / 0.8248 = 4.219$, stars = 4
Water heating environmental impact	$0.216 / 0.8248 = 0.2619$, stars = 4

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					4.8800
Infiltration rate					0.4428 (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) =				0.3764 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.4046	0.3858	0.3858	0.3576	0.3670	0.3199	0.3199	0.3105	0.3199	0.3576	0.3482	0.3764 (22b)
Effective ac	0.5819	0.5744	0.5744	0.5639	0.5673	0.5512	0.5512	0.5482	0.5512	0.5639	0.5606	0.5708 (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
Door -1			2.5500	1.0000	2.5500		(26)
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)
Velux (Uw = 1.50)			1.0600	1.4151	1.5000		(27a)
Ground floor			45.2400	0.0900	4.0716		(28a)
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)
Ceiling	16.8100		16.8100	0.1100	1.8491		(30)
Skelling	31.5900	1.0600	30.5300	0.1600	4.8848		(30)
Total net area of external elements Aum(A, m ²)			138.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7118		(33)
Party Wall			99.8900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4007 (36)
Total fabric heat loss	(33) + (36) = 48.1125 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.6294	38.1356	38.1356	37.4390	37.6653	36.5924	36.5924	36.3955	36.5924	37.4390	37.2185	37.8975 (38)
Heat transfer coeff	86.7419	86.2481	86.2481	85.5514	85.7778	84.7049	84.7049	84.5080	84.7049	85.5514	85.3310	86.0100 (39)
Average = Sum(39)m / 12 =												85.5069 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0682	1.0622	1.0622	1.0536	1.0564	1.0432	1.0432	1.0407	1.0432	1.0536	1.0509	1.0592 (40)
HLP (average)												1.0530 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4852 (42)
Average daily hot water use (litres/day)	93.2243 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Energy content (annual)												Total = Sum(45)m = 1466.7819 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)
Water storage loss:												

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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 %)													89.8000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													1725.9581	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	383.1881	270.0958	165.2019	45.0794	6.3287	0.0000	0.0000	0.0000	0.0000	59.5060	221.7039	398.8066	(98)	
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000	(210)	
Space heating fuel (main heating system)	426.7128	300.7749	183.9665	50.1998	7.0475	0.0000	0.0000	0.0000	0.0000	66.2651	246.8863	444.1054	(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	200.9485	177.1496	186.1237	166.9551	163.6884	146.3736	140.6827	154.2257	153.9073	173.1175	182.9188	196.1501	(64)	
Efficiency of water heater (217)m	85.8070	85.2332	83.7949	81.1559	79.4524	79.1000	79.1000	79.1000	79.1000	81.5868	84.6250	85.9661	(216)	
Fuel for water heating, kWh/month	234.1866	207.8411	222.1180	205.7214	206.0207	185.0488	177.8542	194.9756	194.5731	212.1882	216.1524	228.1713	(219)	
Water heating fuel used												2484.8515	(219)	
Annual totals kWh/year														
Space heating fuel - main system													1725.9581	(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)													349.4241	(232)
Total delivered energy for all uses													4635.2337	(238)

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	1725.9581	3.9200	67.6576 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2484.8515	3.9200	97.4062 (247)
Pumps and fans for heating	75.0000	16.9600	12.7200 (249)
Energy for lighting	349.4241	16.9600	59.2623 (250)
Additional standing charges			88.0000 (251)
Total energy cost			325.0461 (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	1725.9581	0.2160	372.8069 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2484.8515	0.2160	536.7279 (264)
Space and water heating			909.5349 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	349.4241	0.5190	181.3511 (268)
Total kg/year			1129.8110 (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	1725.9581	1.2200	2105.6689 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2484.8515	1.2200	3031.5188 (264)
Space and water heating			5137.1877 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	349.4241	3.0700	1072.7320 (268)
Primary energy kWh/year			6440.1697 (272)
Primary energy kWh/m2/year			79.3124 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating:
Current environmental impact rating:

B 84
B 87

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(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	+ 1.8	-£ 43	-259 kg (22.9%)
U Solar photovoltaic panels	+ 10.6	-£ 317	-971 kg (111.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£43	3.19 kg/m²	B 86 B 90
Solar photovoltaic panels	£317	11.96 kg/m²	A 97 A 99
Total Savings	£361	15.15 kg/m²	

Potential energy efficiency rating: A 97
Potential environmental impact rating: A 99

Fuel prices for cost data on this page from database revision number 442 TEST (29 Apr 2019)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£72	£80	-£8
Mains gas	£253	£201	£52
Space heating	£168	£170	-£1
Water heating	£97	£53	£45
Lighting	£59	£59	£0
Generated (PV)	-£0	-£317	£317
Total cost of fuels	£325	-£36	£361
Total cost of uses	£324	-£35	£361
Delivered energy	57 kWh/m²	18 kWh/m²	39 kWh/m²
Carbon dioxide emissions	1.1 tonnes	-0.1 tonnes	1.2 tonnes
CO2 emissions per m²	14 kg/m²	-1 kg/m²	15 kg/m²
Primary energy	79 kWh/m²	-9 kWh/m²	89 kWh/m²

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					4.8800
Infiltration rate					0.4428 (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)	=	0.3764 (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	0.4799	0.4705	0.4611	0.4140	0.4046	0.3576	0.3576	0.3482	0.3764	0.4046	0.4235	0.4423 (22b)
Effective ac	0.6152	0.6107	0.6063	0.5857	0.5819	0.5639	0.5639	0.5606	0.5708	0.5819	0.5897	0.5978 (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
Door -1			2.5500	1.0000	2.5500		(26)
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)
Velux (Uw = 1.50)			1.0600	1.4151	1.5000		(27a)
Ground floor			45.2400	0.0900	4.0716		(28a)
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)
Ceiling	16.8100		16.8100	0.1100	1.8491		(30)
Skelling	31.5900	1.0600	30.5300	0.1600	4.8848		(30)
Total net area of external elements Aum(A, m ²)			138.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7118		(33)
Party Wall			99.8900	0.0000	0.0000		(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K	250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.4007 (36)
Total fabric heat loss	(33) + (36) = 48.1125 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	40.8398	40.5429	40.2519	38.8851	38.6294	37.4390	37.4390	37.2185	37.8975	38.6294	39.1467	39.6876 (38)
Heat transfer coeff	88.9523	88.6554	88.3644	86.9976	86.7419	85.5514	85.5514	85.3310	86.0100	86.7419	87.2592	87.8000 (39)
Average = Sum(39)m / 12 =												86.9964 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0955	1.0918	1.0882	1.0714	1.0682	1.0536	1.0536	1.0509	1.0592	1.0682	1.0746	1.0813 (40)
HLP (average)												1.0714 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.4852 (42)
Average daily hot water use (litres/day)	93.2243 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Energy content (annual)												Total = Sum(45)m = 1466.7819 (45)
Distribution loss (46)m = 0.15 x (45)m	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)
Water storage loss:												

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9822	0.9656	0.9196	0.7998	0.6119	0.4105	0.2729	0.3137	0.5615	0.8607	0.9646	0.9856	(94)
Useful gains	691.1524	774.3951	843.5623	836.7761	693.3448	460.9473	292.2207	308.4543	495.9552	657.0496	662.2432	659.7358	(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	1319.1739	1277.0089	1154.8808	952.5358	717.7405	463.2493	292.4143	308.8594	507.2728	799.0563	1076.2376	1309.0717	(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	467.2480	337.7564	231.6210	83.3470	18.1504	0.0000	0.0000	0.0000	0.0000	105.6529	298.0760	483.1059	(98)
Space heating												2024.9577	(98)
Space heating per m2											(98) / (4) =	24.9379	(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 %)													89.8000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2254.9641	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	467.2480	337.7564	231.6210	83.3470	18.1504	0.0000	0.0000	0.0000	0.0000	105.6529	298.0760	483.1059	(98)	
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000	(210)	
Space heating fuel (main heating system)	520.3207	376.1208	257.9299	92.8140	20.2120	0.0000	0.0000	0.0000	0.0000	117.6536	331.9332	537.9799	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	165.7615	125.7361	102.3008	53.2866	20.6756	5.8885	1.0375	30.2973	59.1569	107.4721	143.2657	165.1477	(64)	
Efficiency of water heater	86.7279	86.6213	86.2266	85.3000	83.7659	79.1000	79.1000	79.1000	79.1000	84.0656	86.0226	86.8084	(217)	
Fuel for water heating, kWh/month	191.1282	145.1562	118.6419	62.4696	24.6826	7.4444	1.3117	38.3026	74.7875	127.8431	166.5442	190.2438	(219)	
Water heating fuel used												1148.5557	(219)	
Annual totals kWh/year														
Space heating fuel - main system												2254.9641	(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)													349.4241	(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												2150.7045	(238)	

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2254.9641	3.4800	78.4728 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1148.5557	3.4800	39.9697 (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	349.4241	13.1900	46.0890 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			73.1962 (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] =	0.2436 (257)
SAP value		96.6018
SAP rating (Section 12)		97 (258)
SAP band		A

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	2254.9641	0.2160	487.0722 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1148.5557	0.2160	248.0880 (264)
Space and water heating			735.1603 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	349.4241	0.5190	181.3511 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			84.9491 (272)
CO2 emissions per m2			1.0500 (273)
EI value			99.0980
EI rating			99 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.2400 (1b)	x 2.4200 (2b)	= 109.4808 (1b) - (3b)
First floor	35.9600 (1c)	x 2.5500 (2c)	= 91.6980 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	81.2000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 201.1788 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1988 (8)
Pressure test					Yes
Measured/design AP50					4.8800
Infiltration rate					0.4428 (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) =		0.3764 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.8000	3.9000	3.4000	3.4000	3.3000	3.4000	3.8000	3.7000	4.0000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9500	0.9750	0.8500	0.8500	0.8250	0.8500	0.9500	0.9250	1.0000 (22a)
Adj infilt rate	0.4046	0.3858	0.3858	0.3576	0.3670	0.3199	0.3199	0.3105	0.3199	0.3576	0.3482	0.3764 (22b)
Effective ac	0.5819	0.5744	0.5744	0.5639	0.5673	0.5512	0.5512	0.5482	0.5512	0.5639	0.5606	0.5708 (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
Door -1			2.5500	1.0000	2.5500		(26)
W-1.4 (Uw = 1.40)			16.8000	1.3258	22.2727		(27)
Velux (Uw = 1.50)			1.0600	1.4151	1.5000		(27a)
Ground floor			45.2400	0.0900	4.0716		(28a)
Cavity wall	44.7300	19.3500	25.3800	0.2200	5.5836		(29a)
Ceiling	16.8100		16.8100	0.1100	1.8491		(30)
Skelling	31.5900	1.0600	30.5300	0.1600	4.8848		(30)
Total net area of external elements Aum(A, m ²)			138.3700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.7118		(33)
Party Wall			99.8900	0.0000	0.0000		(32)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							5.4007 (36)
Total fabric heat loss						(33) + (36) =	48.1125 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	38.6294	38.1356	38.1356	37.4390	37.6653	36.5924	36.5924	36.3955	36.5924	37.4390	37.2185	37.8975 (38)
Heat transfer coeff	86.7419	86.2481	86.2481	85.5514	85.7778	84.7049	84.7049	84.5080	84.7049	85.5514	85.3310	86.0100 (39)
Average = Sum(39)m / 12 =												85.5069 (39)
HLP	1.0682	1.0622	1.0622	1.0536	1.0564	1.0432	1.0432	1.0407	1.0432	1.0536	1.0509	1.0592 (40)
HLP (average)												1.0530 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.4852 (42)
Average daily hot water use (litres/day)												93.2243 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	102.5468	98.8178	95.0888	91.3599	87.6309	83.9019	83.9019	87.6309	91.3599	95.0888	98.8178	102.5468 (44)
Energy conte	152.0739	133.0048	137.2491	119.6571	114.8138	99.0756	91.8081	105.3511	106.6093	124.2429	135.6208	147.2755 (45)
Energy content (annual)												Total = Sum(45)m = 1466.7819 (45)
Distribution loss (46)m = 0.15 x (45)m												
	22.8111	19.9507	20.5874	17.9486	17.2221	14.8613	13.7712	15.8027	15.9914	18.6364	20.3431	22.0913 (46)
Water storage loss:												

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Storage volume													190.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):													1.5862	(48)
Temperature factor from Table 2b													0.5400	(49)
Enter (49) or (54) in (55)													0.8565	(55)
Total storage loss														
	26.5522	23.9827	26.5522	25.6957	26.5522	25.6957	26.5522	26.5522	25.6957	26.5522	25.6957	26.5522	(56)	
If cylinder contains dedicated solar storage														
	16.0711	14.5158	16.0711	15.5527	16.0711	15.5527	16.0711	16.0711	15.5527	16.0711	15.5527	16.0711	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)	
Total heat required for water heating calculated for each month														
	191.4074	168.5318	175.1868	150.9681	141.3530	124.5335	118.1146	132.5882	139.2711	162.1806	173.6855	186.6089	(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													1169.5850	(H5)
Overshading factor													0.8000	(H6)
Solar energy available													1964.9028	(H7)
Adjustment factor for showers													1.0000	(H7a)
Solar-to-load ratio													1.3396	(H8)
Utilisation factor													0.5260	(H9)
Collector performance factor													0.8793	(H10)
Dedicated solar storage volume													75.0000	(H11)
Effective solar volume													109.5000	(H13)
Daily hot water demand													93.2243	(H14)
Volume ratio Veff/V													1.1746	(H15)
Solar storage volume factor													1.0000	(H16)
Solar input													-908.7372	(H17)
Solar input	-29.0392	-42.3844	-71.7500	-97.7496	-117.7706	-122.5333	-119.6981	-107.1403	-84.1146	-58.1816	-33.9413	-24.4345	(63)	
													-908.7372	(63)
Output from w/h														
	162.3682	126.1474	103.4368	53.2185	23.5824	2.0002	0.0000	25.4479	55.1566	103.9991	139.7443	162.1745	(64)	
													957.2759	(64)
Heat gains from water heating, kWh/month														
	82.0314	72.6457	75.9855	64.8348	59.4069	53.3090	51.5714	56.8189	61.5770	71.6610	75.5457	80.4359	(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	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141	149.1141 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	49.4646	43.9340	35.7295	27.0496	20.2199	17.0705	18.4452	23.9758	32.1803	40.8603	47.6900	50.8394 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	331.2391	334.6764	326.0147	307.5749	284.2981	262.4211	247.8060	244.3688	253.0305	271.4702	294.7470	316.6240 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966	52.3966 (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)	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094	-99.4094 (71)
Water heating gains (Table 5)	110.2572	108.1037	102.1311	90.0484	79.8480	74.0403	69.3164	76.3695	85.5237	96.3185	104.9245	108.1127 (72)
Total internal gains	596.0623	591.8155	568.9766	529.7742	489.4673	458.6332	440.6690	449.8154	475.8358	513.7503	552.4629	580.6775 (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

East	8.4100	23.8018	0.6300	0.7000	0.7700	61.1754 (76)
West	8.3900	23.8018	0.6300	0.7000	0.7700	61.0299 (80)
North	1.0600	19.2832	0.6300	0.7000	1.0000	8.1127 (82)

Solar gains	130.3181	222.5340	366.1629	550.4535	667.3517	728.0986	684.0705	594.6496	456.3732	283.7923	159.9441	107.9159 (83)
Total gains	726.3804	814.3495	935.1395	1080.2277	1156.8190	1186.7318	1124.7395	1044.4650	932.2090	797.5427	712.4070	688.5934 (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	65.0077	65.3799	65.3799	65.9123	65.7384	66.5710	66.5710	66.7261	66.5710	65.9123	66.0826	65.5609
alpha	5.3338	5.3587	5.3587	5.3942	5.3826	5.4381	5.4381	5.4484	5.4381	5.3942	5.4055	5.3707
util living area												
	0.9842	0.9698	0.9211	0.7846	0.5846	0.3701	0.2484	0.2749	0.5358	0.8515	0.9653	0.9874 (86)
MIT	20.3642	20.4822	20.6746	20.8595	20.9332	20.9489	20.9499	20.9500	20.9423	20.8316	20.5773	20.3429 (87)
Th 2	20.0268	20.0318	20.0318	20.0389	20.0366	20.0475	20.0475	20.0495	20.0475	20.0389	20.0412	20.0343 (88)
util rest of house												
	0.9794	0.9608	0.8995	0.7388	0.5209	0.3029	0.1768	0.1982	0.4550	0.8043	0.9532	0.9834 (89)
MIT 2	19.1998	19.3718	19.6369	19.8754	19.9504	19.9739	19.9743	19.9765	19.9700	19.8500	19.5167	19.1756 (90)
Living area fraction												
MIT	19.4402	19.6010	19.8511	20.0786	20.1532	20.1751	20.1757	20.1774	20.1707	20.0526	19.7356	19.4165 (91)
Temperature adjustment												-0.1500
adjusted MIT	19.2902	19.4510	19.7011	19.9286	20.0032	20.0251	20.0257	20.0274	20.0207	19.9026	19.5856	19.2665 (92)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Built)



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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9745	0.9540	0.8907	0.7330	0.5187	0.3013	0.1751	0.1964	0.4527	0.7967	0.9458	0.9792	(94)
Useful gains	707.8561	776.8827	832.9679	791.8538	599.9963	357.5188	196.9859	205.1111	422.0158	635.4063	673.8105	674.2453	(95)
Ext temp.	5.1000	5.7000	7.4000	9.9000	12.9000	15.8000	17.7000	17.6000	15.0000	11.5000	8.0000	5.1000	(96)
Heat loss rate W	1230.8817	1185.9985	1060.9477	857.9571	609.2985	357.8878	196.9984	205.1343	425.2770	718.8579	988.6118	1218.4619	(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	389.1311	274.9259	169.6169	47.5943	6.9209	0.0000	0.0000	0.0000	0.0000	62.0880	226.6570	404.8972	(98)
Space heating												1581.8312	(98)
Space heating per m2												(98) / (4) =	19.4807 (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 %)													89.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													1761.5047 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	389.1311	274.9259	169.6169	47.5943	6.9209	0.0000	0.0000	0.0000	0.0000	62.0880	226.6570	404.8972	(98)
Space heating efficiency (main heating system 1)	89.8000	89.8000	89.8000	89.8000	89.8000	0.0000	0.0000	0.0000	0.0000	89.8000	89.8000	89.8000	(210)
Space heating fuel (main heating system)	433.3308	306.1535	188.8830	53.0004	7.7070	0.0000	0.0000	0.0000	0.0000	69.1403	252.4019	450.8877	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	162.3682	126.1474	103.4368	53.2185	23.5824	2.0002	0.0000	25.4479	55.1566	103.9991	139.7443	162.1745	(64)
Efficiency of water heater													79.1000 (216)
(217)m	86.3606	86.1353	85.4227	83.8148	81.2979	79.1000	79.1000	79.1000	79.1000	82.7876	85.3943	86.4554	(217)
Fuel for water heating, kWh/month	188.0119	146.4527	121.0882	63.4953	29.0074	2.5287	0.0000	32.1718	69.7302	125.6215	163.6458	187.5817	(219)
Water heating fuel used												1129.3353	(219)
Annual totals kWh/year													
Space heating fuel - main system												1761.5047	(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)													349.4241 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 2.50 * 1170 * 0.80) =									-1871.3360			-1871.3360	(233)
Total delivered energy for all uses												1493.9281	(238)

10a. Fuel costs - using BEDF prices (442)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	1761.5047	3.9200	69.0510	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1129.3353	3.9200	44.2699	(247)
Pumps and fans for heating	75.0000	16.9600	12.7200	(249)
Pump for solar water heating	50.0000	16.9600	8.4800	(249)
Energy for lighting	349.4241	16.9600	59.2623	(250)
Additional standing charges			88.0000	(251)
Energy saving/generation technologies				
PV Unit	-1871.3360	16.9600	-317.3786	(252)
Total energy cost			-35.5953	(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	1761.5047	0.2160	380.4850	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1129.3353	0.2160	243.9364	(264)
Space and water heating			624.4214	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	349.4241	0.5190	181.3511	(268)
Energy saving/generation technologies				
PV Unit	-1871.3360	0.5190	-971.2234	(269)

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Total kg/year -100.5758 (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	1761.5047	1.2200	2149.0357 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1129.3353	1.2200	1377.7891 (264)
Space and water heating			3526.8247 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	349.4241	3.0700	1072.7320 (268)
Energy saving/generation technologies			
PV Unit	-1871.3360	3.0700	-5745.0015 (269)
Primary energy kWh/year			-761.6947 (272)
Primary energy kWh/m2/year			-9.3805 (273)