

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



FALCON
ENERGY
LIMITED

Property Reference	MB Baseline plot 1	Issued on Date	24/01/2022
Assessment Reference	Reduction	Prop Type Ref	
Property	Manor Barn, 1, Ecclesden lane, Angmering, BN16 4DQ		

SAP Rating	88 B	DER	11.86	TSL	31.56
Environmental	89 B	2 DER-TFR	62.42		
CO ₂ Emissions (t/year)	0.91	DERE	65.24	TFRS	77.91
General Requirements Compliance	Pass	2 DERE-TFR	16.27		

Assessor Details		Assessor ID	M057-0001
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Client	
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CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.0000 (1b)	x	3.2000 (2b) = 227.2000 (1b) - (3b)
First floor	48.0000 (1c)	x	2.6000 (2c) = 124.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.0000		(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) = 352.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
					Air changes per hour
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.2920 (18)
Number of sides sheltered					1 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.9250 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2701 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.6000	5.1000	4.8000	4.4000	4.6000	4.2000	4.3000	4.1000	4.4000	4.8000	4.8000	5.1000 (22)
Wind factor	1.4000	1.2750	1.2000	1.1000	1.1500	1.0500	1.0750	1.0250	1.1000	1.2000	1.2000	1.2750 (22a)
Adj infilt rate	0.3782	0.3444	0.3242	0.2972	0.3107	0.2836	0.2904	0.2769	0.2972	0.3242	0.3242	0.3444 (22b)
Effective ac	0.5715	0.5593	0.5525	0.5442	0.5483	0.5402	0.5422	0.5383	0.5442	0.5525	0.5525	0.5593 (25)

3. Heat losses and heat loss parameter

Element	Gross			Openings		NetArea		U-value		A x U		K-value	A x K	
	m2			m2		m2		W/m2K		W/K		kJ/m2K	kJ/K	
Opening 1 Windows (Uw = 1.20)						17.7600		1.1450		20.3359			(27)	
Opening 2 Glazed Door (Uw = 1.20)						43.4300		1.1450		49.7290			(27)	
Heat Loss Floor 1						74.0000		0.1600		11.8400			(28a)	
External Wall 1	164.0000			61.1900		102.8100		0.1600		16.4496			(29a)	
External Wall 2	36.0000					36.0000		0.0000		0.0000			(29a)	
External Roof 1 Main	71.0000					71.0000		0.1600		11.3600			(30)	
Total net area of external elements Aum(A, m2)						309.0000							(31)	
Fabric heat loss, W/K = Sum (A x U)								(26)... (30) + (32) =		109.7145			(33)	
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K														
Thermal bridges (Sum(L x Psi) calculated using Appendix K)													100.0000 (35)	
Total fabric heat loss													27.6182 (36)	
													(33) + (36) = 137.3327 (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		
	66.3874	64.9702	64.1834	63.2086	63.6854	62.7529	62.9781	62.5331	63.2086	64.1834	64.1834	64.9702	(38)	
Heat transfer coeff														
	203.7201	202.3029	201.5161	200.5413	201.0181	200.0856	200.3108	199.8657	200.5413	201.5161	201.5161	202.3029	(39)	

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Calculation of Heat Demand 09 Jan 2014

Average = Sum(39)m / 12 = 201.2697 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.7119	1.7000	1.6934	1.6852	1.6892	1.6814	1.6833	1.6795	1.6852	1.6934	1.6934	1.7000 (40)
HLP (average)												1.6913 (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 2.8594 (42)
Average daily hot water use (litres/day) 102.1100 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.3210	108.2366	104.1522	100.0678	95.9834	91.8990	91.8990	95.9834	100.0678	104.1522	108.2366	112.3210 (44)
Energy content	166.5687	145.6821	150.3308	131.0621	125.7572	108.5189	100.5587	115.3926	116.7707	136.0850	148.5475	161.3129 (45)
Energy content (annual)										Total = Sum(45)m =		1606.5872 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9853	21.8523	22.5496	19.6593	18.8636	16.2778	15.0838	17.3089	17.5156	20.4128	22.2821	24.1969 (46)
Water storage loss:												
Store volume												200.0000 (47)
b) If manufacturer declared loss factor is not known:												
Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8434 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9372 (55)
Total storage loss	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527 (56)
If cylinder contains dedicated solar storage	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527 (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	218.8838	192.9344	202.6459	181.6896	178.0723	159.1464	152.8738	167.7077	167.3982	188.4001	199.1750	213.6280 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	218.8838	192.9344	202.6459	181.6896	178.0723	159.1464	152.8738	167.7077	167.3982	188.4001	199.1750	213.6280 (64)
RHI water heating demand										Total per year (kWh/year) = Sum(64)m =		2222.5552 (64)
Heat gains from water heating, kWh/month	97.2362	86.2412	91.8371	84.0801	83.6663	76.5845	75.2878	80.2201	79.3283	87.1003	89.8940	95.4886 (65)
												2223 (64)

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	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.2760	56.2012	45.7059	34.6023	25.8656	21.8368	23.5955	30.6703	41.1656	52.2692	61.0058	65.0346 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	423.7397	428.1367	417.0562	393.4671	363.6900	335.7038	317.0073	312.6102	323.6907	347.2799	377.0569	405.0431 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156 (69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747 (71)
Water heating gains (Table 5)	130.6938	128.3351	123.4369	116.7780	112.4547	106.3674	101.1933	107.8227	110.1782	117.0704	124.8528	128.3449 (72)
Total internal gains	729.9123	724.8759	698.4019	657.0502	614.2133	576.1110	553.9990	563.3061	587.2374	628.8223	675.1185	710.6256 (73)

6. Solar gains

[Jan]		Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
North		2.1000	14.2444	0.7600	0.7000	0.7700	11.0283 (74)					
East		7.2600	26.6336	0.7600	0.7000	0.7700	71.2873 (76)					
South		2.1000	59.7356	0.7600	0.7000	0.7700	46.2485 (78)					
West		6.3000	26.6336	0.7600	0.7000	0.7700	61.8609 (80)					
North		9.3600	14.2444	0.7600	0.7000	0.7700	49.1547 (74)					
East		11.2800	26.6336	0.7600	0.7000	0.7700	110.7604 (76)					
West		22.7900	26.6336	0.7600	0.7000	0.7700	223.7792 (80)					
Solar gains	574.1193	933.8237	1512.1857	2272.8091	2714.9623	2999.7816	2818.6221	2424.2955	1878.7524	1174.8366	686.2504	456.9156 (83)
Total gains	1304.0316	1658.6996	2210.5876	2929.8594	3329.1755	3575.8925	3372.6211	2987.6016	2465.9898	1803.6589	1361.3688	1167.5412 (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)												
tau	16.2260	16.3396	16.4034	16.4832	16.4441	16.5207	16.5021	16.5389	16.4832	16.4034	16.4034	16.3396
alpha	2.0817	2.0893	2.0936	2.0989	2.0963	2.1014	2.1001	2.1026	2.0989	2.0936	2.0936	2.0893
util living area	0.8983	0.8496	0.7461	0.5904	0.4386	0.2987	0.2233	0.2316	0.4146	0.6710	0.8457	0.9127 (86)

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Tweekday	17.0559	17.4420	18.1499	18.8011	19.1687	19.3248	19.3577	19.3621	19.2746	18.8306	17.9040	16.9972
Tweekend	19.7318	19.9115	20.2492	20.5763	20.7777	20.8735	20.9007	20.9010	20.8316	20.5728	20.1170	19.7014
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.0428	19.3162	19.8412	20.3384	20.6569	20.8056	20.8467	20.8472	20.7370	20.3406	19.6212	18.9958 (87)
Th 2	19.5323	19.5408	19.5456	19.5514	19.5486	19.5542	19.5528	19.5555	19.5514	19.5456	19.5456	19.5408 (88)
util rest of house	0.8809	0.8262	0.7105	0.5417	0.3773	0.2290	0.1435	0.1421	0.3270	0.6080	0.8156	0.8972 (89)
Tweekday	17.0559	17.4420	18.1499	18.8011	19.1687	19.3248	19.3577	19.3621	19.2746	18.8306	17.9040	16.9972
Tweekend	17.0559	17.4420	18.1499	18.8011	19.1687	19.3248	19.3577	19.3621	19.2746	18.8306	17.9040	16.9972
MIT 2	17.0559	17.4420	18.1499	18.8011	19.1687	19.3248	19.3577	19.3621	19.2746	18.8306	17.9040	16.9972 (90)
Living area fraction									fLA = Living area / (4) =			
MIT	18.2948	18.6106	19.2045	19.7597	20.0967	20.2482	20.2862	20.2881	20.1864	19.7721	18.9747	18.2434 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2948	18.6106	19.2045	19.7597	20.0967	20.2482	20.2862	20.2881	20.1864	19.7721	18.9747	18.2434 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8628	0.8086	0.7012	0.5491	0.4012	0.2631	0.1846	0.1883	0.3669	0.6187	0.8015	0.8798 (94)
Useful gains	1125.0737	1341.1766	1550.0826	1608.8786	1335.6547	940.9595	622.4462	562.4562	904.7702	1115.9684	1091.1571	1027.1552 (95)
Ext temp.	5.7000	5.9000	7.4000	9.6000	12.6000	15.3000	17.1000	17.4000	15.2000	12.2000	8.6000	5.9000 (96)
Heat loss rate W	2565.8138	2571.3910	2378.7945	2037.4354	1506.9631	990.0563	638.2212	577.2328	999.9869	1525.9077	2050.3744	2497.0979 (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	1071.9107	826.7041	616.5617	308.5610	127.4535	0.0000	0.0000	0.0000	0.0000	304.9948	690.6365	1093.6374 (98)
Space heating												5040.4594 (98)
RHI space heating demand												5040 (98)

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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.0000 (1b)	x 3.2000 (2b)	= 227.2000 (1b) - (3b)
First floor	48.0000 (1c)	x 2.6000 (2c)	= 124.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	352.0000 (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) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.2920 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2701 (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	0.3444	0.3377	0.3309	0.2972	0.2904	0.2566	0.2566	0.2499	0.2701	0.2904	0.3039	0.3174 (22b)
Effective ac	0.5593	0.5570	0.5548	0.5442	0.5422	0.5329	0.5329	0.5312	0.5365	0.5422	0.5462	0.5504 (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 1 Windows (Uw = 1.20)			17.7600	1.1450	20.3359		(27)
Opening 2 Glazed Door (Uw = 1.20)			43.4300	1.1450	49.7290		(27)
Heat Loss Floor 1			74.0000	0.1600	11.8400		(28a)
External Wall 1	164.0000	61.1900	102.8100	0.1600	16.4496		(29a)
External Wall 2	36.0000		36.0000	0.0000	0.0000		(29a)
External Roof 1 Main	71.0000		71.0000	0.1600	11.3600		(30)
Total net area of external elements Aum(A, m ²)			309.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.7145		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6182 (36)
Total fabric heat loss						(33) + (36) =	137.3327 (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	64.9702	64.7026	64.4404	63.2086	62.9781	61.9052	61.9052	61.7066	62.3185	62.9781	63.4443	63.9318 (38)
Average = Sum(39)m / 12 =	202.3029	202.0353	201.7731	200.5413	200.3108	199.2379	199.2379	199.0392	199.6512	200.3108	200.7770	201.2644 (39)
												200.5402 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.7000	1.6978	1.6956	1.6852	1.6833	1.6743	1.6743	1.6726	1.6777	1.6833	1.6872	1.6913 (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												2.8594 (42)
Average daily hot water use (litres/day)												102.1100 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	112.3210	108.2366	104.1522	100.0678	95.9834	91.8990	91.8990	95.9834	100.0678	104.1522	108.2366	112.3210 (44)
Energy content (annual)	166.5687	145.6821	150.3308	131.0621	125.7572	108.5189	100.5587	115.3926	116.7707	136.0850	148.5475	161.3129 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.9853	21.8523	22.5496	19.6593	18.8636	16.2778	15.0838	17.3089	17.5156	20.4128	22.2821	24.1969 (46)
Water storage loss:												
Store volume												200.0000 (47)
b) If manufacturer declared loss factor is not known :												

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Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)	
Volume factor from Table 2a												0.8434 (52)	
Temperature factor from Table 2b												0.5400 (53)	
Enter (49) or (54) in (55)												0.9372 (55)	
Total storage loss													
	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527 (56)	
If cylinder contains dedicated solar storage													
	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527 (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													
	218.8838	192.9344	202.6459	181.6896	178.0723	159.1464	152.8738	167.7077	167.3982	188.4001	199.1750	213.6280 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
								Solar input (sum of months) = Sum(63)m =					0.0000 (63)
Output from w/h													
	218.8838	192.9344	202.6459	181.6896	178.0723	159.1464	152.8738	167.7077	167.3982	188.4001	199.1750	213.6280 (64)	
								Total per year (kWh/year) = Sum(64)m =					2222.5552 (64)
Heat gains from water heating, kWh/month													
	97.2362	86.2412	91.8371	84.0801	83.6663	76.5845	75.2878	80.2201	79.3283	87.1003	89.8940	95.4886 (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	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.2760	56.2012	45.7059	34.6023	25.8656	21.8368	23.5955	30.6703	41.1656	52.2692	61.0058	65.0346	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	423.7397	428.1367	417.0562	393.4671	363.6900	335.7038	317.0073	312.6102	323.6907	347.2799	377.0569	405.0431	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	(71)
Water heating gains (Table 5)	130.6938	128.3351	123.4369	116.7780	112.4547	106.3674	101.1933	107.8227	110.1782	117.0704	124.8528	128.3449	(72)
Total internal gains	729.9123	724.8759	698.4019	657.0502	614.2133	576.1110	553.9990	563.3061	587.2374	628.8223	675.1185	710.6256	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.1000	10.6334	0.7600	0.7000	0.7700	8.2326 (74)
East	7.2600	19.6403	0.7600	0.7000	0.7700	52.5689 (76)
South	2.1000	46.7521	0.7600	0.7000	0.7700	36.1964 (78)
West	6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)
North	9.3600	10.6334	0.7600	0.7000	0.7700	36.6938 (74)
East	11.2800	19.6403	0.7600	0.7000	0.7700	81.6773 (76)
West	22.7900	19.6403	0.7600	0.7000	0.7700	165.0200 (80)

Solar gains	426.0065	819.8027	1332.4825	1940.1263	2390.5236	2456.4633	2334.5721	1994.0402	1546.5208	966.6883	528.3570	352.3455	(83)
Total gains	1155.9188	1544.6786	2030.8844	2597.1765	3004.7369	3032.5742	2888.5711	2557.3463	2133.7582	1595.5106	1203.4755	1062.9710	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.3396	16.3613	16.3825	16.4832	16.5021	16.5910	16.5910	16.6076	16.5567	16.5021	16.4638	16.4239	
alpha	2.0893	2.0908	2.0922	2.0989	2.1001	2.1061	2.1061	2.1072	2.1038	2.1001	2.0976	2.0949	
util living area	0.9274	0.8770	0.7894	0.6540	0.5083	0.3783	0.2859	0.3305	0.5229	0.7623	0.8948	0.9376	(86)
Tweekday	16.5661	17.1066	17.8552	18.6000	19.0599	19.2849	19.3518	19.3414	19.1669	18.4668	17.3645	16.4570	
Tweekend	19.5074	19.7564	20.1080	20.4709	20.7117	20.8394	20.8869	20.8748	20.7570	20.3853	19.8660	19.4561	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	18.6964	19.0762	19.6233	20.1739	20.5551	20.7534	20.8254	20.8068	20.6206	20.0513	19.2294	18.6172	(87)
Th 2	19.5408	19.5424	19.5440	19.5514	19.5528	19.5593	19.5593	19.5605	19.5568	19.5528	19.5500	19.5471	(88)
util rest of house	0.9154	0.8581	0.7592	0.6092	0.4495	0.3045	0.1984	0.2362	0.4412	0.7161	0.8751	0.9271	(89)
Tweekday	16.5661	17.1066	17.8552	18.6000	19.0599	19.2849	19.3518	19.3414	19.1669	18.4668	17.3645	16.4570	
Tweekend	16.5661	17.1066	17.8552	18.6000	19.0599	19.2849	19.3518	19.3414	19.1669	18.4668	17.3645	16.4570	
MIT 2	16.5661	17.1066	17.8552	18.6000	19.0599	19.2849	19.3518	19.3414	19.1669	18.4668	17.3645	16.4570	(90)
Living area fraction									fLA = Living area / (4) =			0.6235	(91)
MIT	17.8944	18.3347	18.9577	19.5814	19.9922	20.2005	20.2706	20.2551	20.0733	19.4548	18.5273	17.8039	(92)
Temperature adjustment												0.0000	
adjusted MIT	17.8944	18.3347	18.9577	19.5814	19.9922	20.2005	20.2706	20.2551	20.0733	19.4548	18.5273	17.8039	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8982	0.8393	0.7454	0.6102	0.4681	0.3383	0.2426	0.2830	0.4722	0.7125	0.8579	0.9109	(94)
Useful gains	1038.2780	1296.3782	1513.8477	1584.7931	1406.6096	1025.9343	700.6356	723.7911	1007.4541	1136.8548	1032.4716	968.3133	(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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



**FALCON
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Calculation of Energy Ratings 09 Jan 2014

Heat loss rate W	2750.1826	2714.2886	2513.6225	2142.0545	1661.0221	1115.8397	731.3292	767.3258	1192.5762	1773.7129	2294.3423	2737.9860 (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	1273.6570	952.8358	743.8325	401.2282	189.2829	0.0000	0.0000	0.0000	0.0000	473.8224	908.5468	1316.6365 (98)
Space heating												6259.8422 (98)
Space heating per m2										(98) / (4) =		52.6037 (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 %)												242.8803 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												2577.3364 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1273.6570	952.8358	743.8325	401.2282	189.2829	0.0000	0.0000	0.0000	0.0000	473.8224	908.5468	1316.6365 (98)
Space heating efficiency (main heating system 1)	242.8803	242.8803	242.8803	242.8803	242.8803	0.0000	0.0000	0.0000	0.0000	242.8803	242.8803	242.8803 (210)
Space heating fuel (main heating system)	524.3970	392.3068	306.2548	165.1959	77.9326	0.0000	0.0000	0.0000	0.0000	195.0847	374.0719	542.0928 (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	218.8838	192.9344	202.6459	181.6896	178.0723	159.1464	152.8738	167.7077	167.3982	188.4001	199.1750	213.6280 (64)
Efficiency of water heater	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350 (216)
(217)m	81.9069	72.1965	75.8306	67.9887	66.6351	59.5530	57.2058	62.7566	62.6408	70.4998	74.5318	79.9401 (219)
Fuel for water heating, kWh/month												831.6857 (219)
Water heating fuel used												2577.3364 (211)
Annual totals kWh/year												0.0000 (215)
Space heating fuel - main system												2577.3364 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												446.9894 (232)
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M, N and Q)												
PV Unit 0 (0.80 * 1.95 * 1080 * 0.80) =												
Total delivered energy for all uses												-1347.2467 (233)
												2508.7647 (238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	2577.3364	13.1900	339.9507 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	831.6857	13.1900	109.6993 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	446.9894	13.1900	58.9579 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1347.2467	13.1900	-177.7018 (252)
Total energy cost			330.9061 (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] =	0.8474 (257)
SAP value		88.1782
SAP rating (Section 12)		88 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2577.3364	0.5190	1337.6376 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	831.6857	0.5190	431.6449 (264)
Space and water heating			1769.2825 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	446.9894	0.5190	231.9875 (268)
Energy saving/generation technologies			
PV Unit	-1347.2467	0.5190	-699.2211 (269)
Total kg/year			1302.0489 (272)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CO2 emissions per m2	10.9400 (273)
EI value	89.3613
EI rating	89 (274)
EI band	B

----- Calculation of stars for heating and DHW

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.4288 = 5.824$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.4288 = 0.2292$, stars = 4
Water heating energy efficiency	$13.19 / 2.6724 = 4.936$, stars = 4
Water heating environmental impact	$0.519 / 2.6724 = 0.1942$, stars = 5

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.0000 (1b)	x 3.2000 (2b)	= 227.2000 (1b) - (3b)
First floor	48.0000 (1c)	x 2.6000 (2c)	= 124.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 352.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					50.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.2920 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2701 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.6000	5.1000	4.8000	4.4000	4.6000	4.2000	4.3000	4.1000	4.4000	4.8000	4.8000	5.1000 (22)
Wind factor	1.4000	1.2750	1.2000	1.1000	1.1500	1.0500	1.0750	1.0250	1.1000	1.2000	1.2000	1.2750 (22a)
Adj infilt rate	0.3782	0.3444	0.3242	0.2972	0.3107	0.2836	0.2904	0.2769	0.2972	0.3242	0.3242	0.3444 (22b)
Effective ac	0.5715	0.5593	0.5525	0.5442	0.5483	0.5402	0.5422	0.5383	0.5442	0.5525	0.5525	0.5593 (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 1 Windows (Uw = 1.20)			17.7600	1.1450	20.3359		(27)
Opening 2 Glazed Door (Uw = 1.20)			43.4300	1.1450	49.7290		(27)
Heat Loss Floor 1			74.0000	0.1600	11.8400		(28a)
External Wall 1	164.0000	61.1900	102.8100	0.1600	16.4496		(29a)
External Wall 2	36.0000		36.0000	0.0000	0.0000		(29a)
External Roof 1 Main	71.0000		71.0000	0.1600	11.3600		(30)
Total net area of external elements Aum(A, m ²)			309.0000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7145		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6182 (36)
Total fabric heat loss						(33) + (36) =	137.3327 (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	66.3874	64.9702	64.1834	63.2086	63.6854	62.7529	62.9781	62.5331	63.2086	64.1834	64.1834	64.9702 (38)
Heat transfer coeff	203.7201	202.3029	201.5161	200.5413	201.0181	200.0856	200.3108	199.8657	200.5413	201.5161	201.5161	202.3029 (39)
Average = Sum(39)m / 12 =												201.2697 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.7119	1.7000	1.6934	1.6852	1.6892	1.6814	1.6833	1.6795	1.6852	1.6934	1.6934	1.7000 (40)
HLP (average)												1.6913 (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												2.8594 (42)
Average daily hot water use (litres/day)												102.1100 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.3210	108.2366	104.1522	100.0678	95.9834	91.8990	91.8990	95.9834	100.0678	104.1522	108.2366	112.3210 (44)
Energy conte	166.5687	145.6821	150.3308	131.0621	125.7572	108.5189	100.5587	115.3926	116.7707	136.0850	148.5475	161.3129 (45)
Energy content (annual)										Total = Sum(45)m =		1606.5872 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9853	21.8523	22.5496	19.6593	18.8636	16.2778	15.0838	17.3089	17.5156	20.4128	22.2821	24.1969 (46)
Water storage loss:												
Store volume												200.0000 (47)

b) If manufacturer declared loss factor is not known :

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Calculation Type: New Build (As Designed)



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

Hot water storage loss factor from Table 2 (kWh/litre/day)												0.0103 (51)
Volume factor from Table 2a												0.8434 (52)
Temperature factor from Table 2b												0.5400 (53)
Enter (49) or (54) in (55)												0.9372 (55)
Total storage loss	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527 (56)
If cylinder contains dedicated solar storage	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527 (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	218.8838	192.9344	202.6459	181.6896	178.0723	159.1464	152.8738	167.7077	167.3982	188.4001	199.1750	213.6280 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	218.8838	192.9344	202.6459	181.6896	178.0723	159.1464	152.8738	167.7077	167.3982	188.4001	199.1750	213.6280 (64)
Heat gains from water heating, kWh/month	97.2362	86.2412	91.8371	84.0801	83.6663	76.5845	75.2878	80.2201	79.3283	87.1003	89.8940	95.4886 (65)
Total per year (kWh/year) = Sum(64)m =												2222.5552 (64)

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	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	63.2760	56.2012	45.7059	34.6023	25.8656	21.8368	23.5955	30.6703	41.1656	52.2692	61.0058	65.0346	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	423.7397	428.1367	417.0562	393.4671	363.6900	335.7038	317.0073	312.6102	323.6907	347.2799	377.0569	405.0431	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	(71)
Water heating gains (Table 5)	130.6938	128.3351	123.4369	116.7780	112.4547	106.3674	101.1933	107.8227	110.1782	117.0704	124.8528	128.3449	(72)
Total internal gains	729.9123	724.8759	698.4019	657.0502	614.2133	576.1110	553.9990	563.3061	587.2374	628.8223	675.1185	710.6256	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	Specific data FF or Table 6c	Access factor Table 6d	Gains W	
North	2.1000	14.2444	0.7600	0.7000	0.7700	11.0283	(74)
East	7.2600	26.6336	0.7600	0.7000	0.7700	71.2873	(76)
South	2.1000	59.7356	0.7600	0.7000	0.7700	46.2485	(78)
West	6.3000	26.6336	0.7600	0.7000	0.7700	61.8609	(80)
North	9.3600	14.2444	0.7600	0.7000	0.7700	49.1547	(74)
East	11.2800	26.6336	0.7600	0.7000	0.7700	110.7604	(76)
West	22.7900	26.6336	0.7600	0.7000	0.7700	223.7792	(80)

Solar gains	574.1193	933.8237	1512.1857	2272.8091	2714.9623	2999.7816	2818.6221	2424.2955	1878.7524	1174.8366	686.2504	456.9156	(83)
Total gains	1304.0316	1658.6996	2210.5876	2929.8594	3329.1755	3575.8925	3372.6211	2987.6016	2465.9898	1803.6589	1361.3688	1167.5412	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	16.2260	16.3396	16.4034	16.4832	16.4441	16.5207	16.5021	16.5389	16.4832	16.4034	16.4034	16.3396	
alpha	2.0817	2.0893	2.0936	2.0989	2.0963	2.1014	2.1001	2.1026	2.0989	2.0936	2.0936	2.0893	
util living area	0.8983	0.8496	0.7461	0.5904	0.4386	0.2987	0.2233	0.2316	0.4146	0.6710	0.8457	0.9127	(86)
Tweekday	17.0559	17.4420	18.1499	18.8011	19.1687	19.3248	19.3577	19.3621	19.2746	18.8306	17.9040	16.9972	
Tweekend	19.7318	19.9115	20.2492	20.5763	20.7777	20.8735	20.9007	20.9010	20.8316	20.5728	20.1170	19.7014	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	19.0428	19.3162	19.8412	20.3384	20.6569	20.8056	20.8467	20.8472	20.7370	20.3406	19.6212	18.9958	(87)
Th 2	19.5323	19.5408	19.5456	19.5514	19.5486	19.5542	19.5528	19.5555	19.5514	19.5456	19.5456	19.5408	(88)
util rest of house	0.8809	0.8262	0.7105	0.5417	0.3773	0.2290	0.1435	0.1421	0.3270	0.6080	0.8156	0.8972	(89)
Tweekday	17.0559	17.4420	18.1499	18.8011	19.1687	19.3248	19.3577	19.3621	19.2746	18.8306	17.9040	16.9972	
Tweekend	17.0559	17.4420	18.1499	18.8011	19.1687	19.3248	19.3577	19.3621	19.2746	18.8306	17.9040	16.9972	
MIT 2	17.0559	17.4420	18.1499	18.8011	19.1687	19.3248	19.3577	19.3621	19.2746	18.8306	17.9040	16.9972	(90)
Living area fraction									fLA = Living area / (4) =			0.6235	(91)
MIT	18.2948	18.6106	19.2045	19.7597	20.0967	20.2482	20.2862	20.2881	20.1864	19.7721	18.9747	18.2434	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2948	18.6106	19.2045	19.7597	20.0967	20.2482	20.2862	20.2881	20.1864	19.7721	18.9747	18.2434	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.8628	0.8086	0.7012	0.5491	0.4012	0.2631	0.1846	0.1883	0.3669	0.6187	0.8015	0.8798	(94)
Useful gains	1125.0737	1341.1766	1550.0826	1608.8786	1335.6547	940.9595	622.4462	562.4562	904.7702	1115.9684	1091.1571	1027.1552	(95)
Ext temp.	5.7000	5.9000	7.4000	9.6000	12.6000	15.3000	17.1000	17.4000	15.2000	12.2000	8.8000	5.9000	(96)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

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Heat loss rate W	2565.8138	2571.3910	2378.7945	2037.4354	1506.9631	990.0563	638.2212	577.2328	999.9869	1525.9077	2050.3744	2497.0979 (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	1071.9107	826.7041	616.5617	308.5610	127.4535	0.0000	0.0000	0.0000	0.0000	304.9948	690.6365	1093.6374 (98)
Space heating												5040.4594 (98)
Space heating per m2										(98) / (4) =		42.3568 (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 %)												243.6198 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												2068.9861 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1071.9107	826.7041	616.5617	308.5610	127.4535	0.0000	0.0000	0.0000	0.0000	304.9948	690.6365	1093.6374 (98)
Space heating efficiency (main heating system 1)	243.6198	243.6198	243.6198	243.6198	243.6198	0.0000	0.0000	0.0000	0.0000	243.6198	243.6198	243.6198 (210)
Space heating fuel (main heating system)	439.9933	339.3419	253.0836	126.6568	52.3165	0.0000	0.0000	0.0000	0.0000	125.1930	283.4895	448.9116 (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	218.8838	192.9344	202.6459	181.6896	178.0723	159.1464	152.8738	167.7077	167.3982	188.4001	199.1750	213.6280 (64)
Efficiency of water heater	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350 (216)
(217)m	81.9069	72.1965	75.8306	67.9887	66.6351	59.5530	57.2058	62.7566	62.6408	70.4998	74.5318	79.9401 (219)
Fuel for water heating, kWh/month												831.6857 (219)
Water heating fuel used												2068.9861 (211)
Annual totals kWh/year												0.0000 (215)
Space heating fuel - main system												0.0000 (231)
Space heating fuel - secondary												446.9894 (232)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												446.9894 (232)
Electricity for lighting (calculated in Appendix L)												
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 1.95 * 1281 * 0.80) =												
Total delivered energy for all uses										-1598.0749		-1598.0749 (233)
												1749.5862 (238)

10a. Fuel costs - using BEDF prices (488)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2068.9861	19.4400	402.2109 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	831.6857	19.4400	161.6797 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	446.9894	19.4400	86.8947 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1598.0749	19.4400	-310.6658 (252)
Total energy cost			340.1196 (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	2068.9861	0.5190	1073.8038 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	831.6857	0.5190	431.6449 (264)
Space and water heating			1505.4487 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	446.9894	0.5190	231.9875 (268)
Energy saving/generation technologies			
PV Unit	-1598.0749	0.5190	-829.4009 (269)
Total kg/year			908.0352 (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	2068.9861	3.0700	6351.7874 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	831.6857	3.0700	2553.2750 (264)

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Space and water heating			8905.0624 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	446.9894	3.0700	1372.2574 (268)
Energy saving/generation technologies			
PV Unit	-1598.0749	3.0700	-4906.0900 (269)
Primary energy kWh/year			5371.2297 (272)
Primary energy kWh/m ² /year			45.1364 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 88
Current environmental impact rating: B 89

(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	Already installed
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	+ 1.4	-£ 63	-168 kg (18.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£63 1.41 kg/m ²	B 90	B 91
Total Savings	£63 1.41 kg/m ²		

Potential energy efficiency rating: B 90
Potential environmental impact rating: B 91

Fuel prices for cost data on this page from database revision number 488 TEST (12 Jan 2022)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£651	£588	£63
Space heating	£402	£402	£0
Water heating	£162	£99	£63
Lighting	£87	£87	£0
Generated (PV)	-£311	-£311	£0
Total cost of fuels	£340	£277	£63
Total cost of uses	£340	£277	£63
Delivered energy	15 kWh/m ²	12 kWh/m ²	3 kWh/m ²
Carbon dioxide emissions	0.9 tonnes	0.7 tonnes	0.2 tonnes
CO2 emissions per m ²	8 kg/m ²	6 kg/m ²	1 kg/m ²
Primary energy	45 kWh/m ²	37 kWh/m ²	8 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



FALCON
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.0000 (1b)	x 3.2000 (2b)	= 227.2000 (1b) - (3b)
First floor	48.0000 (1c)	x 2.6000 (2c)	= 124.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 352.0000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					5 * 10 = 50.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					50.0000 / (5) = 0.1420 (8)
Pressure test					Yes
Measured/design AP50					3.0000
Infiltration rate					0.2920 (18)
Number of sides sheltered					1 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.9250 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2701 (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	0.3444	0.3377	0.3309	0.2972	0.2904	0.2566	0.2566	0.2499	0.2701	0.2904	0.3039	0.3174 (22b)
Effective ac	0.5593	0.5570	0.5548	0.5442	0.5422	0.5329	0.5329	0.5312	0.5365	0.5422	0.5462	0.5504 (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 1 Windows (Uw = 1.20)			17.7600	1.1450	20.3359		(27)
Opening 2 Glazed Door (Uw = 1.20)			43.4300	1.1450	49.7290		(27)
Heat Loss Floor 1			74.0000	0.1600	11.8400		(28a)
External Wall 1	164.0000	61.1900	102.8100	0.1600	16.4496		(29a)
External Wall 2	36.0000		36.0000	0.0000	0.0000		(29a)
External Roof 1 Main	71.0000		71.0000	0.1600	11.3600		(30)
Total net area of external elements Aum(A, m ²)			309.0000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		109.7145		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							100.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							27.6182 (36)
Total fabric heat loss						(33) + (36) =	137.3327 (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	64.9702	64.7026	64.4404	63.2086	62.9781	61.9052	61.9052	61.7066	62.3185	62.9781	63.4443	63.9318 (38)
Average = Sum(39)m / 12 =	202.3029	202.0353	201.7731	200.5413	200.3108	199.2379	199.2379	199.0392	199.6512	200.3108	200.7770	201.2644 (39)
												200.5402 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.7000	1.6978	1.6956	1.6852	1.6833	1.6743	1.6743	1.6726	1.6777	1.6833	1.6872	1.6913 (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												2.8594 (42)
Average daily hot water use (litres/day)												102.1100 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	112.3210	108.2366	104.1522	100.0678	95.9834	91.8990	91.8990	95.9834	100.0678	104.1522	108.2366	112.3210 (44)
Energy conte	166.5687	145.6821	150.3308	131.0621	125.7572	108.5189	100.5587	115.3926	116.7707	136.0850	148.5475	161.3129 (45)
Energy content (annual)										Total = Sum(45)m =		1606.5872 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9853	21.8523	22.5496	19.6593	18.8636	16.2778	15.0838	17.3089	17.5156	20.4128	22.2821	24.1969 (46)
Water storage loss:												
Store volume												200.0000 (47)

b) If manufacturer declared loss factor is not known :

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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8434 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.9372 (55)
Total storage loss													
29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	28.1155	(56)
If cylinder contains dedicated solar storage													
29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	28.1155	(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													
218.8838	192.9344	201.2502	174.9360	165.2780	146.5397	139.8468	155.6112	161.9954	187.0044	199.1750	213.6280	213.6280	(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													1.1289 (H8)
Utilisation factor													0.5876 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													102.1100 (H14)
Volume ratio Veff/V													0.7345 (H15)
Solar storage volume factor													0.9383 (H16)
Solar input													-879.2691 (H17)
Solar input	-25.4971	-42.5472	-72.4628	-97.1145	-119.9768	-117.9563	-116.3974	-101.6970	-79.6492	-54.3910	-30.2432	-21.3367	(63)
Solar input (sum of months) = Sum(63)m =													-879.2691 (63)
Output from w/h													
193.3868	150.3872	128.7874	77.8215	45.3012	28.5834	23.4494	53.9142	82.3462	132.6134	168.9318	192.2913	192.2913	(64)
Total per year (kWh/year) = Sum(64)m =													1277.8137 (64)
Heat gains from water heating, kWh/month													
97.2362	86.2412	90.7205	78.6773	73.4309	66.4992	64.8663	70.5429	75.0060	85.9837	89.8940	95.4886	95.4886	(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	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
63.2760	56.2012	45.7059	34.6023	25.8656	21.8368	23.5955	30.6703	41.1656	52.2692	61.0058	65.0346	65.0346	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
423.7397	428.1367	417.0562	393.4671	363.6900	335.7038	317.0073	312.6102	323.6907	347.2799	377.0569	405.0431	405.0431	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	(71)
Water heating gains (Table 5)													
130.6938	128.3351	121.9361	109.2740	98.6974	92.3599	87.1859	94.8158	104.1750	115.5696	124.8528	128.3449	128.3449	(72)
Total internal gains													
729.9123	724.8759	696.9011	649.5462	600.4560	562.1035	539.9915	550.2992	581.2342	627.3215	675.1185	710.6256	710.6256	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
North		2.1000	10.6334	0.7600	0.7000	0.7700	8.2326 (74)
East		7.2600	19.6403	0.7600	0.7000	0.7700	52.5689 (76)
South		2.1000	46.7521	0.7600	0.7000	0.7700	36.1964 (78)
West		6.3000	19.6403	0.7600	0.7000	0.7700	45.6176 (80)
North		9.3600	10.6334	0.7600	0.7000	0.7700	36.6938 (74)
East		11.2800	19.6403	0.7600	0.7000	0.7700	81.6773 (76)
West		22.7900	19.6403	0.7600	0.7000	0.7700	165.0200 (80)

Solar gains	426.0065	819.8027	1332.4825	1940.1263	2390.5236	2456.4633	2334.5721	1994.0402	1546.5208	966.6883	528.3570	352.3455	(83)
Total gains	1155.9188	1544.6786	2029.3836	2589.6725	2990.9796	3018.5667	2874.5636	2544.3394	2127.7550	1594.0098	1203.4755	1062.9710	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	16.3396	16.3613	16.3825	16.4832	16.5021	16.5910	16.5910	16.6076	16.5567	16.5021	16.4638	16.4239
alpha	2.0893	2.0908	2.0922	2.0989	2.1001	2.1061	2.1061	2.1072	2.1038	2.1001	2.0976	2.0949
util living area	0.9274	0.8770	0.7896	0.6550	0.5099	0.3798	0.2871	0.3320	0.5239	0.7626	0.8948	0.9376 (86)
Tweekday	16.5661	17.1066	17.8542	18.5974	19.0578	19.2842	19.3516	19.3411	19.1660	18.4660	17.3645	16.4570
Tweekend	19.5074	19.7564	20.1075	20.4695	20.7104	20.8388	20.8866	20.8745	20.7564	20.3849	19.8660	19.4561
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	18.6964	19.0762	19.6226	20.1716	20.5531	20.7525	20.8250	20.8063	20.6196	20.0507	19.2294	18.6172 (87)
Th 2	19.5408	19.5424	19.5440	19.5514	19.5528	19.5593	19.5593	19.5605	19.5568	19.5528	19.5500	19.5471 (88)
util rest of house												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	0.9154	0.8581	0.7594	0.6102	0.4510	0.3057	0.1993	0.2373	0.4422	0.7164	0.8751	0.9271 (89)
Tweekday	16.5661	17.1066	17.8542	18.5974	19.0578	19.2842	19.3516	19.3411	19.1660	18.4660	17.3645	16.4570
Tweekend	16.5661	17.1066	17.8542	18.5974	19.0578	19.2842	19.3516	19.3411	19.1660	18.4660	17.3645	16.4570
MIT 2	16.5661	17.1066	17.8542	18.5974	19.0578	19.2842	19.3516	19.3411	19.1660	18.4660	17.3645	16.4570 (90)
Living area fraction									fLA = Living area / (4) =			0.6235 (91)
MIT	17.8944	18.3347	18.9569	19.5790	19.9902	20.1997	20.2703	20.2547	20.0724	19.4541	18.5273	17.8039 (92)
Temperature adjustment												0.0000
adjusted MIT	17.8944	18.3347	18.9569	19.5790	19.9902	20.1997	20.2703	20.2547	20.0724	19.4541	18.5273	17.8039 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8982	0.8393	0.7456	0.6111	0.4696	0.3396	0.2436	0.2843	0.4731	0.7128	0.8579	0.9109 (94)	
Useful gains	1038.2780	1296.3782	1513.1455	1582.6732	1404.6558	1025.1070	700.3052	723.3195	1006.5836	1136.2287	1032.4716	968.3133 (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	2750.1826	2714.2886	2513.4576	2141.5778	1660.6114	1115.6736	731.2622	767.2299	1192.3910	1773.5679	2294.3423	2737.9860 (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	1273.6570	952.8358	744.2322	402.4113	190.4310	0.0000	0.0000	0.0000	0.0000	474.1804	908.5468	1316.6365 (98)	
Space heating												6262.9310 (98)	
Space heating per m2												(98) / (4) =	52.6297 (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 %)													242.8803 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													2578.6082 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1273.6570	952.8358	744.2322	402.4113	190.4310	0.0000	0.0000	0.0000	0.0000	474.1804	908.5468	1316.6365 (98)	
Space heating efficiency (main heating system 1)	242.8803	242.8803	242.8803	242.8803	242.8803	0.0000	0.0000	0.0000	0.0000	242.8803	242.8803	242.8803 (210)	
Space heating fuel (main heating system)	524.3970	392.3068	306.4194	165.6830	78.4053	0.0000	0.0000	0.0000	0.0000	195.2321	374.0719	542.0928 (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	193.3868	150.3872	128.7874	77.8215	45.3012	28.5834	23.4494	53.9142	82.3462	132.6134	168.9318	192.2913 (64)	
Efficiency of water heater	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350 (216)	
Fuel for water heating, kWh/month	72.3658	56.2752	48.1925	29.1210	16.9518	10.6960	8.7748	20.1748	30.8142	49.6243	63.2147	71.9559 (219)	
Water heating fuel used												478.1611 (219)	
Annual totals kWh/year													
Space heating fuel - main system												2578.6082 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													50.0000 (231)
Electricity for lighting (calculated in Appendix L)													446.9894 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 1.95 * 1080 * 0.80) =										-1347.2467			-1347.2467 (233)
Total delivered energy for all uses													2206.5119 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2578.6082	13.1900	340.1184 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	478.1611	13.1900	63.0694 (247)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Pump for solar water heating	50.0000	13.1900	6.5950 (249)	
Energy for lighting	446.9894	13.1900	58.9579 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1347.2467	13.1900	-177.7016 (252)	
Total energy cost			291.0389 (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] =	0.7453 (257)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP value 89.6025
SAP rating (Section 12) 90 (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	2578.6082	0.5190	1338.2977 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	478.1611	0.5190	248.1656 (264)
Space and water heating			1586.4632 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	446.9894	0.5190	231.9875 (268)
Energy saving/generation technologies			
FV Unit	-1347.2467	0.5190	-699.2211 (269)
Total kg/year			1145.1797 (272)
CO2 emissions per m2			9.6200 (273)
EI value			90.6430
EI rating			91 (274)
EI band			B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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 Designed) (Version 9.92, January 2014)
CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	71.0000 (1b)	x 3.2000 (2b)	= 227.2000 (1b) - (3b)
First floor	48.0000 (1c)	x 2.6000 (2c)	= 124.8000 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	119.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 352.0000 (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)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						50.0000 / (5) =	0.1420 (8)				
Pressure test							Yes					
Measured/design AP50							3.0000					
Infiltration rate							0.2920 (18)					
Number of sides sheltered							1 (19)					
Shelter factor							(20) = 1 - [0.075 x (19)] =	0.9250 (20)				
Infiltration rate adjusted to include shelter factor							(21) = (18) x (20) =	0.2701 (21)				
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.6000	5.1000	4.8000	4.4000	4.6000	4.2000	4.3000	4.1000	4.4000	4.8000	4.8000	5.1000 (22)
Wind factor	1.4000	1.2750	1.2000	1.1000	1.1500	1.0500	1.0750	1.0250	1.1000	1.2000	1.2000	1.2750 (22a)
Adj infilt rate	0.3782	0.3444	0.3242	0.2972	0.3107	0.2836	0.2904	0.2769	0.2972	0.3242	0.3242	0.3444 (22b)
Effective ac	0.5715	0.5593	0.5525	0.5442	0.5483	0.5402	0.5422	0.5383	0.5442	0.5525	0.5525	0.5593 (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 1 Windows (Uw = 1.20)			17.7600	1.1450	20.3359			(27)				
Opening 2 Glazed Door (Uw = 1.20)			43.4300	1.1450	49.7290			(27)				
Heat Loss Floor 1			74.0000	0.1600	11.8400			(28a)				
External Wall 1	164.0000	61.1900	102.8100	0.1600	16.4496			(29a)				
External Wall 2	36.0000		36.0000	0.0000	0.0000			(29a)				
External Roof 1 Main	71.0000		71.0000	0.1600	11.3600			(30)				
Total net area of external elements Aum(A, m2)			309.0000					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	109.7145			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								100.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								27.6182 (36)				
Total fabric heat loss						(33) + (36) =		137.3327 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 66.3874	Feb 64.9702	Mar 64.1834	Apr 63.2086	May 63.6854	Jun 62.7529	Jul 62.9781	Aug 62.5331	Sep 63.2086	Oct 64.1834	Nov 64.1834	Dec 64.9702 (38)
Heat transfer coeff	203.7201	202.3029	201.5161	200.5413	201.0181	200.0856	200.3108	199.8657	200.5413	201.5161	201.5161	202.3029 (39)
Average = Sum(39)m / 12 =												201.2697 (39)
HLP	Jan 1.7119	Feb 1.7000	Mar 1.6934	Apr 1.6852	May 1.6892	Jun 1.6814	Jul 1.6833	Aug 1.6795	Sep 1.6852	Oct 1.6934	Nov 1.6934	Dec 1.7000 (40)
HLP (average)												1.6913 (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												2.8594 (42)
Average daily hot water use (litres/day)												102.1100 (43)
Daily hot water use	Jan 112.3210	Feb 108.2366	Mar 104.1522	Apr 100.0678	May 95.9834	Jun 91.8990	Jul 91.8990	Aug 95.9834	Sep 100.0678	Oct 104.1522	Nov 108.2366	Dec 112.3210 (44)
Energy conte	166.5687	145.6821	150.3308	131.0621	125.7572	108.5189	100.5587	115.3926	116.7707	136.0850	148.5475	161.3129 (45)
Energy content (annual)										Total = Sum(45)m =		1606.5872 (45)
Distribution loss (46)m = 0.15 x (45)m	24.9853	21.8523	22.5496	19.6593	18.8636	16.2778	15.0838	17.3089	17.5156	20.4128	22.2821	24.1969 (46)
Water storage loss:												
Store volume												200.0000 (47)
b) If manufacturer declared loss factor is not known :												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Hot water storage loss factor from Table 2 (kWh/litre/day)													0.0103 (51)
Volume factor from Table 2a													0.8434 (52)
Temperature factor from Table 2b													0.5400 (53)
Enter (49) or (54) in (55)													0.9372 (55)
Total storage loss													
	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(56)
If cylinder contains dedicated solar storage													
	29.0527	26.2411	29.0527	28.1155	29.0527	28.1155	29.0527	29.0527	28.1155	29.0527	28.1155	29.0527	(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													
	218.8838	192.9344	201.2502	174.9360	165.2780	146.5397	139.8468	155.6112	161.9954	187.0044	199.1750	213.6280	(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													1280.5088 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													2151.2547 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.3390 (H8)
Utilisation factor													0.5261 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													102.1100 (H14)
Volume ratio Veff/V													0.7345 (H15)
Solar storage volume factor													0.9383 (H16)
Solar input													-933.7949 (H17)
Solar input	-30.3407	-42.7937	-72.7047	-100.8528	-121.0987	-128.1723	-124.9794	-109.7239	-85.6277	-58.3849	-34.6818	-24.4343	(63)
													Solar input (sum of months) = Sum(63)m = -933.7949 (63)
Output from w/h													
	188.5431	150.1407	128.5455	74.0831	44.1792	18.3674	14.8675	45.8873	76.3676	128.6194	164.4932	189.1937	(64)
													Total per year (kWh/year) = Sum(64)m = 1223.2879 (64)
Heat gains from water heating, kWh/month													
	97.2362	86.2412	90.7205	78.6773	73.4309	66.4992	64.8663	70.5429	75.0060	85.9837	89.8940	95.4886	(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	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
63.2760	56.2012	45.7059	34.6023	25.8656	21.8368	23.5955	30.6703	41.1656	52.2692	61.0058	65.0346	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
423.7397	428.1367	417.0562	393.4671	363.6900	335.7038	317.0073	312.6102	323.6907	347.2799	377.0569	405.0431	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	55.0156	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)												
-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	-114.3747	(71)
Water heating gains (Table 5)												
130.6938	128.3351	121.9361	109.2740	98.6974	92.3599	87.1859	94.8158	104.1750	115.5696	124.8528	128.3449	(72)
Total internal gains												
729.9123	724.8759	696.9011	649.5462	600.4560	562.1035	539.9915	550.2992	581.2342	627.3215	675.1185	710.6256	(73)

6. Solar gains

[Jan]		Area	Solar flux	g	FF	Access	Gains
		m2	Table 6a	Specific data	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
North		2.1000	14.2444	0.7600	0.7000	0.7700	11.0283 (74)
East		7.2600	26.6336	0.7600	0.7000	0.7700	71.2873 (76)
South		2.1000	59.7356	0.7600	0.7000	0.7700	46.2485 (78)
West		6.3000	26.6336	0.7600	0.7000	0.7700	61.8609 (80)
North		9.3600	14.2444	0.7600	0.7000	0.7700	49.1547 (74)
East		11.2800	26.6336	0.7600	0.7000	0.7700	110.7604 (76)
West		22.7900	26.6336	0.7600	0.7000	0.7700	223.7792 (80)

Solar gains	574.1193	933.8237	1512.1857	2272.8091	2714.9623	2999.7816	2818.6221	2424.2955	1878.7524	1174.8366	686.2504	456.9156 (83)
Total gains	1304.0316	1658.6996	2209.0868	2922.3554	3315.4182	3561.8851	3358.6136	2974.5947	2459.9866	1802.1581	1361.3688	1167.5412 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	16.2260	16.3396	16.4034	16.4832	16.4441	16.5207	16.5021	16.5389	16.4832	16.4034	16.4034	16.3396
alpha	2.0817	2.0893	2.0936	2.0989	2.0963	2.1014	2.1001	2.1026	2.0989	2.0936	2.0936	2.0893
util living area												
	0.8983	0.8496	0.7463	0.5913	0.4400	0.2997	0.2242	0.2325	0.4154	0.6713	0.8457	0.9127 (86)
Tweekday	17.0559	17.4420	18.1491	18.7992	19.1674	19.3245	19.3577	19.3620	19.2742	18.8301	17.9040	16.9972
Tweekend	19.7318	19.9115	20.2488	20.5752	20.7768	20.8732	20.9005	20.9009	20.8312	20.5725	20.1170	19.7014
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0
MIT	19.0428	19.3162	19.8406	20.3368	20.6556	20.8052	20.8465	20.8470	20.7365	20.3402	19.6212	18.9958 (87)
Th 2	19.5323	19.5408	19.5456	19.5514	19.5486	19.5542	19.5528	19.5555	19.5514	19.5456	19.5456	19.5408 (88)
util rest of house												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

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	0.8809	0.8262	0.7107	0.5426	0.3785	0.2299	0.1441	0.1427	0.3276	0.6082	0.8156	0.8972 (89)
Tweekday	17.0559	17.4420	18.1491	18.7992	19.1674	19.3245	19.3577	19.3620	19.2742	18.8301	17.9040	16.9972
Tweekend	17.0559	17.4420	18.1491	18.7992	19.1674	19.3245	19.3577	19.3620	19.2742	18.8301	17.9040	16.9972
MIT 2	17.0559	17.4420	18.1491	18.7992	19.1674	19.3245	19.3577	19.3620	19.2742	18.8301	17.9040	16.9972 (90)
Living area fraction									fLA = Living area / (4) =			0.6235 (91)
MIT	18.2948	18.6106	19.2038	19.7579	20.0953	20.2478	20.2860	20.2879	20.1860	19.7716	18.9747	18.2434 (92)
Temperature adjustment												0.0000
adjusted MIT	18.2948	18.6106	19.2038	19.7579	20.0953	20.2478	20.2860	20.2879	20.1860	19.7716	18.9747	18.2434 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.8628	0.8086	0.7014	0.5500	0.4025	0.2641	0.1853	0.1890	0.3676	0.6190	0.8015	0.8798 (94)
Useful gains	1125.0737	1341.1766	1549.4803	1607.2619	1334.3566	940.5452	622.2926	562.3050	904.3252	1115.5294	1091.1571	1027.1552 (95)
Ext temp.	5.7000	5.9000	7.4000	9.6000	12.6000	15.3000	17.1000	17.4000	15.2000	12.2000	8.8000	5.9000 (96)
Heat loss rate W	2565.8138	2571.3910	2378.6550	2037.0813	1506.6968	989.9742	638.1895	577.2011	999.8951	1525.8090	2050.3744	2497.0979 (97)
Month fractl	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	1071.9107	826.7041	616.9060	309.4700	128.2211	0.0000	0.0000	0.0000	0.0000	305.2481	690.6365	1093.6374 (98)
Space heating												5042.7336 (98)
Space heating per m2										(98) / (4) =		42.3759 (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 %)													243.6198 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													2069.9196 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1071.9107	826.7041	616.9060	309.4700	128.2211	0.0000	0.0000	0.0000	0.0000	305.2481	690.6365	1093.6374 (98)	
Space heating efficiency (main heating system 1)	243.6198	243.6198	243.6198	243.6198	243.6198	0.0000	0.0000	0.0000	0.0000	243.6198	243.6198	243.6198 (210)	
Space heating fuel (main heating system)	439.9933	339.3419	253.2249	127.0299	52.6316	0.0000	0.0000	0.0000	0.0000	125.2969	283.4895	448.9116 (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	188.5431	150.1407	128.5455	74.0831	44.1792	18.3674	14.8675	45.8873	76.3676	128.6194	164.4932	189.1937 (64)	
Efficiency of water heater	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350 (216)	
(217)m	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350	267.2350 (217)	
Fuel for water heating, kWh/month	70.5533	56.1830	48.1021	27.7221	16.5320	6.8731	5.5634	17.1711	28.5770	48.1297	61.5538	70.7968 (219)	
Water heating fuel used												457.7574 (219)	
Annual totals kWh/year													
Space heating fuel - main system												2069.9196 (211)	
Space heating fuel - secondary												0.0000 (215)	
Electricity for pumps and fans:													
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													50.0000 (231)
Electricity for lighting (calculated in Appendix L)													446.9894 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 1.95 * 1281 * 0.80) =										-1598.0749			-1598.0749 (233)
Total delivered energy for all uses													1426.5914 (238)

10a. Fuel costs - using BEDF prices (488)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2069.9196	19.4400	402.3924 (240)	
Space heating - secondary	0.0000	0.0000	0.0000 (242)	
Water heating (other fuel)	457.7574	19.4400	88.9880 (247)	
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)	
Pump for solar water heating	50.0000	19.4400	9.7200 (249)	
Energy for lighting	446.9894	19.4400	86.8947 (250)	
Additional standing charges			0.0000 (251)	
Energy saving/generation technologies				
PV Unit	-1598.0749	19.4400	-310.6658 (252)	
Total energy cost			277.3294 (255)	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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Space heating - main system 1	2069.9196	0.5190	1074.2883 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	457.7574	0.5190	237.5761 (264)
Space and water heating			1311.8644 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	446.9894	0.5190	231.9875 (268)
Energy saving/generation technologies			
PV Unit	-1598.0749	0.5190	-829.4009 (269)
Total kg/year			740.4009 (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	2069.9196	3.0700	6354.6532 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	457.7574	3.0700	1405.3151 (264)
Space and water heating			7759.9683 (265)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	446.9894	3.0700	1372.2574 (268)
Energy saving/generation technologies			
PV Unit	-1598.0749	3.0700	-4906.0900 (269)
Primary energy kWh/year			4379.6357 (272)
Primary energy kWh/m2/year			36.8037 (273)