

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP Rating	81 B	DER	20.95	TSL	21.17
Environmental	81 B	2 DER-TSL	1.04		
CO ₂ Emissions (t/year)	2.09	DER	69.84	TSL	77.91
General Requirements Compliance	Pass	2 DER-TSL	10.36		

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	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)
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				4.0000	
Infiltration rate				0.3420 (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) =		0.3164 (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	0.4429	0.4034	0.3797	0.3480	0.3639	0.3322	0.3401	0.3243	0.3480	0.3797	0.3797	0.4034 (22b)
Effective ac	0.5981	0.5814	0.5721	0.5606	0.5662	0.5552	0.5578	0.5526	0.5606	0.5721	0.5721	0.5814 (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 = 1.30)			17.7600	1.2357	21.9468			(27)					
Opening 2 Glazed Door (Uw = 1.30)			43.4300	1.2357	53.6683			(27)					
Heat Loss Floor 1			74.0000	0.1800	13.3200			(28a)					
External Wall 1	164.0000	61.1900	102.8100	0.1800	18.5058			(29a)					
External Wall 2	36.0000		36.0000	0.0000	0.0000			(29a)					
External Roof 1 Main	71.0000		71.0000	0.1800	12.7800			(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) =	120.2208			(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) =	147.8390	(37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 69.4755	Feb 67.5314	Mar 66.4522	Apr 65.1150	May 65.7691	Jun 64.4900	Jul 64.7988	Aug 64.1884	Sep 65.1150	Oct 66.4522	Nov 66.4522	Dec 67.5314	(38)
Heat transfer coeff	217.3145	215.3705	214.2912	212.9540	213.6081	212.3290	212.6379	212.0274	212.9540	214.2912	214.2912	215.3705	(39)

FULL SAP CALCULATION PRINTOUT

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FALCON
ENERGY
LIMITED

CALCULATION OF HEAT DEMAND 09 Jan 2014

Average = Sum(39)m / 12 = 213.9533 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.8262	1.8098	1.8008	1.7895	1.7950	1.7843	1.7869	1.7817	1.7895	1.8008	1.8008	1.8098 (40)
HLP (average)												1.7979 (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)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Metabolic gains (Table 5), Watts	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	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)	-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	732.9123	727.8759	701.4019	660.0502	617.2133	579.1110	556.9990	566.3061	590.2374	631.8223	678.1185	713.6256 (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	1307.0316	1661.6996	2213.5876	2932.8594	3332.1755	3578.8925	3375.6211	2990.6016	2468.9898	1806.6589	1364.3688	1170.5412 (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	15.2109	15.3482	15.4255	15.5224	15.4749	15.5681	15.5455	15.5902	15.5224	15.4255	15.4255	15.3482
alpha	2.0141	2.0232	2.0284	2.0348	2.0317	2.0379	2.0364	2.0393	2.0348	2.0284	2.0284	2.0232
util living area	0.9015	0.8553	0.7565	0.6054	0.4550	0.3127	0.2349	0.2433	0.4307	0.6840	0.8514	0.9152 (86)

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FALCON
ENERGY
LIMITED

CALCULATION OF HEAT DEMAND 09 Jan 2014

MIT	18.9104	19.1910	19.7298	20.2683	20.6131	20.7851	20.8357	20.8365	20.7108	20.2717	19.5343	18.8703 (87)
Th 2	19.4517	19.4631	19.4695	19.4773	19.4735	19.4810	19.4792	19.4828	19.4773	19.4695	19.4695	19.4631 (88)
util rest of house												
	0.8840	0.8317	0.7203	0.5549	0.3898	0.2370	0.1472	0.1451	0.3368	0.6191	0.8210	0.8995 (89)
MIT 2	16.8359	17.2260	17.9564	18.6503	19.0568	19.2383	19.2772	19.2829	19.1811	18.6932	17.7239	16.7883 (90)
Living area fraction									fLA = Living area / (4) =			0.6235 (91)
MIT	18.1294	18.4512	19.0622	19.6592	20.0272	20.2027	20.2490	20.2516	20.1349	19.6774	18.8527	18.0865 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9794	18.3012	18.9122	19.5092	19.8772	20.0527	20.0990	20.1016	19.9849	19.5274	18.7027	17.9365 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8629	0.8101	0.7053	0.5560	0.4078	0.2663	0.1837	0.1862	0.3697	0.6218	0.8024	0.8793 (94)	
Useful gains	1127.7987	1346.1762	1561.3280	1630.7089	1358.9209	953.0332	620.2112	556.7929	912.9041	1123.4608	1094.7249	1029.2699 (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	2668.4929	2670.8609	2466.9583	2110.1956	1554.4755	1009.1466	637.6954	572.8188	1018.9694	1570.2058	2122.0704	2592.3070 (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	1146.2765	890.1881	673.7890	345.2304	145.4926	0.0000	0.0000	0.0000	0.0000	332.3782	739.6887	1162.8996 (98)	
Space heating												5435.9431 (98)	
RHI space heating demand												5436 (98)	

FULL SAP CALCULATION PRINTOUT

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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	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					4.0000
Infiltration rate					0.3420 (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) =	0.3164 (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	0.4034	0.3955	0.3876	0.3480	0.3401	0.3006	0.3006	0.2927	0.3164	0.3401	0.3559	0.3718 (22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5578	0.5452	0.5452	0.5428	0.5501	0.5578	0.5633	0.5691 (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 = 1.30)			17.7600	1.2357	21.9468		(27)
Opening 2 Glazed Door (Uw = 1.30)			43.4300	1.2357	53.6683		(27)
Heat Loss Floor 1			74.0000	0.1800	13.3200		(28a)
External Wall 1	164.0000	61.1900	102.8100	0.1800	18.5058		(29a)
External Wall 2	36.0000		36.0000	0.0000	0.0000		(29a)
External Roof 1 Main	71.0000		71.0000	0.1800	12.7800		(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) =	120.2208		(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) =	147.8390 (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	67.5314	67.1644	66.8047	65.1150	64.7988	63.3272	63.3272	63.0546	63.8940	64.7988	65.4384	66.1070 (38)
Heat transfer coeff	215.3705	215.0035	214.6437	212.9540	212.6379	211.1662	211.1662	210.8937	211.7331	212.6379	213.2774	213.9460 (39)
Average = Sum(39)m / 12 =												212.9525 (39)
HLP	1.8098	1.8068	1.8037	1.7895	1.7869	1.7745	1.7745	1.7722	1.7793	1.7869	1.7922	1.7979 (40)
HLP (average)												1.7895 (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	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:												200.0000 (47)
Store volume												
b) If manufacturer declared loss factor is not known :												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



**FALCON
ENERGY
LIMITED**

Calculation of Energy Ratings 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												
(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	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)	-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	732.9123	727.8759	701.4019	660.0502	617.2133	579.1110	556.9990	566.3061	590.2374	631.8223	678.1185	713.6256 (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	1158.9188	1547.6786	2033.8844	2600.1765	3007.7369	3035.5742	2891.5711	2560.3463	2136.7582	1598.5106	1206.4755	1065.9710 (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)												
tau	15.3482	15.3744	15.4002	15.5224	15.5455	15.6538	15.6538	15.6740	15.6119	15.5455	15.4989	15.4504
alpha	2.0232	2.0250	2.0267	2.0348	2.0364	2.0436	2.0436	2.0449	2.0408	2.0364	2.0333	2.0300
util living area	0.9291	0.8813	0.7979	0.6675	0.5243	0.3935	0.2992	0.3448	0.5385	0.7717	0.8980	0.9388 (86)
MIT	18.5597	18.9450	19.5016	20.0939	20.4999	20.7245	20.8105	20.7889	20.5827	19.9673	19.1367	18.4844 (87)
Th 2	19.4631	19.4653	19.4674	19.4773	19.4792	19.4879	19.4879	19.4895	19.4845	19.4792	19.4754	19.4715 (88)
util rest of house	0.9171	0.8623	0.7674	0.6214	0.4625	0.3143	0.2039	0.2427	0.4525	0.7246	0.8781	0.9282 (89)
MIT 2	16.3434	16.8829	17.6482	18.4351	18.9369	19.1936	19.2715	19.2599	19.0625	18.3120	17.1728	16.2411 (90)
Living area fraction												0.6235 (91)
MIT	17.7253	18.1687	18.8039	19.4694	19.9115	20.1482	20.2311	20.2132	20.0103	19.3441	18.3974	17.6398 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5753	18.0187	18.6539	19.3194	19.7615	19.9982	20.0811	20.0632	19.8603	19.1941	18.2474	17.4898 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	1040.3015	1300.2414	1522.5458	1601.9824	1427.5803	1038.5873	701.1857	724.7712	1015.9275	1141.9285	1034.9495	970.1305 (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	2859.1135	2820.5568	2608.7506	2218.8476	1714.1727	1139.9153	735.0863	772.5551	1219.6562	1827.4315	2377.4869	2843.3073 (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	1353.1962	1021.6520	808.1364	444.1430	213.2247	0.0000	0.0000	0.0000	0.0000	510.0142	966.6270	1393.6435 (98)
Space heating												6710.6369 (98)
Space heating per m2												56.3919 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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 %)														93.8000 (206)
Efficiency of secondary/supplementary heating system, %														0.0000 (208)
Space heating requirement														7154.1971 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1353.1962	1021.6520	808.1364	444.1430	213.2247	0.0000	0.0000	0.0000	0.0000	510.0142	966.6270	1393.6435	(98)	
Space heating efficiency (main heating system 1)	93.8000	93.8000	93.8000	93.8000	93.8000	0.0000	0.0000	0.0000	0.0000	93.8000	93.8000	93.8000	(210)	
Space heating fuel (main heating system)	1442.6398	1089.1812	861.5527	473.4999	227.3184	0.0000	0.0000	0.0000	0.0000	543.7252	1030.5191	1485.7607	(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 (217)m	89.1420	88.9133	88.4317	87.4101	85.5965	80.1000	80.1000	80.1000	80.1000	87.6419	88.7740	89.2160	(216)	
Fuel for water heating, kWh/month	245.5450	216.9916	229.1553	207.8588	208.0369	198.6846	190.8537	209.3729	208.9866	214.9659	224.3619	239.4504	(219)	
Water heating fuel used												2594.2635	(219)	
Annual totals kWh/year														
Space heating fuel - main system													7154.1971	(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)													446.9894	(232)
Total delivered energy for all uses													10270.4500	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7154.1971	3.4800	248.9661 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2594.2635	3.4800	90.2804 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	446.9894	13.1900	58.9579 (250)
Additional standing charges			120.0000 (251)
Total energy cost			528.0968 (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] =	1.3524 (257)
SAP value		81.1334
SAP rating (Section 12)		81 (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	7154.1971	0.2160	1545.3066 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2594.2635	0.2160	560.3609 (264)
Space and water heating			2105.6675 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	446.9894	0.5190	231.9875 (268)
Total kg/year			2376.5800 (272)
CO2 emissions per m2			19.9700 (273)
EI value			80.5816
EI rating			81 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.25) / 0.9080 = 4.110$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.25) / 0.9080 = 0.2551$, stars = 4
Water heating energy efficiency	$3.48 / 0.8546 = 4.072$, stars = 4
Water heating environmental impact	$0.216 / 0.8546 = 0.2527$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

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					4.0000
Infiltration rate					0.3420 (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) =	0.3164 (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	0.4429	0.4034	0.3797	0.3480	0.3639	0.3322	0.3401	0.3243	0.3480	0.3797	0.3797	0.4034 (22b)
Effective ac	0.5981	0.5814	0.5721	0.5606	0.5662	0.5552	0.5578	0.5526	0.5606	0.5721	0.5721	0.5814 (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 = 1.30)			17.7600	1.2357	21.9468		(27)
Opening 2 Glazed Door (Uw = 1.30)			43.4300	1.2357	53.6683		(27)
Heat Loss Floor 1			74.0000	0.1800	13.3200		(28a)
External Wall 1	164.0000	61.1900	102.8100	0.1800	18.5058		(29a)
External Wall 2	36.0000		36.0000	0.0000	0.0000		(29a)
External Roof 1 Main	71.0000		71.0000	0.1800	12.7800		(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) =	120.2208		(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) =	147.8390 (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	69.4755	67.5314	66.4522	65.1150	65.7691	64.4900	64.7988	64.1884	65.1150	66.4522	66.4522	67.5314 (38)
Heat transfer coeff	217.3145	215.3705	214.2912	212.9540	213.6081	212.3290	212.6379	212.0274	212.9540	214.2912	214.2912	215.3705 (39)
Average = Sum(39)m / 12 =												213.9533 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.8262	1.8098	1.8008	1.7895	1.7950	1.7843	1.7869	1.7817	1.7895	1.8008	1.8008	1.8098 (40)
HLP (average)												1.7979 (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 :

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



**FALCON
ENERGY
LIMITED**

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 =													(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 =													(64)

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

Metabolic gains (Table 5), Watts													
(66)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	171.5620	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), 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)
Cooking gains (calculated in Appendix L, equation L15 or L15a), 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)
Pumps, fans	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)
Losses e.g. evaporation (negative values) (Table 5)	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)
Water heating gains (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)
Total internal gains	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)
	732.9123	727.8759	701.4019	660.0502	617.2133	579.1110	556.9990	566.3061	590.2374	631.8223	678.1185	713.6256	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	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	1307.0316	1661.6996	2213.5876	2932.8594	3332.1755	3578.8925	3375.6211	2990.6016	2468.9898	1806.6589	1364.3688	1170.5412	(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	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	15.2109	15.3482	15.4255	15.5224	15.4749	15.5681	15.5455	15.5902	15.5224	15.4255	15.4255	15.3482	
util living area	2.0141	2.0232	2.0284	2.0348	2.0317	2.0379	2.0364	2.0393	2.0348	2.0284	2.0284	2.0232	
	0.9015	0.8553	0.7565	0.6054	0.4550	0.3127	0.2349	0.2433	0.4307	0.6840	0.8514	0.9152	(86)
MIT	18.9104	19.1910	19.7298	20.2683	20.6131	20.7851	20.8357	20.8365	20.7108	20.2717	19.5343	18.8703	(87)
Th 2	19.4517	19.4631	19.4695	19.4773	19.4735	19.4810	19.4792	19.4828	19.4773	19.4695	19.4695	19.4631	(88)
util rest of house	0.8840	0.8317	0.7203	0.5549	0.3898	0.2370	0.1472	0.1451	0.3368	0.6191	0.8210	0.8995	(89)
MIT 2	16.8359	17.2260	17.9564	18.6503	19.0568	19.2383	19.2772	19.2829	19.1811	18.6932	17.7239	16.7883	(90)
Living area fraction	18.1294	18.4512	19.0622	19.6592	20.0272	20.2027	20.2490	20.2516	20.1349	19.6774	18.8527	18.0865	(91)
MIT	18.1294	18.4512	19.0622	19.6592	20.0272	20.2027	20.2490	20.2516	20.1349	19.6774	18.8527	18.0865	(92)
Temperature adjustment	17.9794	18.3012	18.9122	19.5092	19.8772	20.0527	20.0990	20.1016	19.9849	19.5274	18.7027	-0.1500	
adjusted MIT	17.9794	18.3012	18.9122	19.5092	19.8772	20.0527	20.0990	20.1016	19.9849	19.5274	18.7027	17.9365	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.8629	0.8101	0.7053	0.5560	0.4078	0.2663	0.1837	0.1862	0.3697	0.6218	0.8024	0.8793	(94)
Ext temp.	1127.7987	1346.1762	1561.3280	1630.7089	1358.9209	953.0332	620.2112	556.7929	912.9041	1123.4608	1094.7249	1029.2699	(95)
Heat loss rate W	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)
Month fracti	2668.4929	2670.8609	2466.9583	2110.1956	1554.4755	1009.1466	637.6954	572.8188	1018.9694	1570.2058	2122.0704	2592.3070	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1146.2765	890.1881	673.7890	345.2304	145.4926	0.0000	0.0000	0.0000	0.0000	332.3782	739.6887	1162.8996	(98)
Space heating per m2													(98) / (4) = 45.6802 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



FALCON
ENERGY
LIMITED

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

8c. Space cooling requirement

Not applicable

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

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 %)														93.8000 (206)
Efficiency of secondary/supplementary heating system, %														0.0000 (208)
Space heating requirement														5795.2485 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1146.2765	890.1881	673.7890	345.2304	145.4926	0.0000	0.0000	0.0000	0.0000	332.3782	739.6887	1162.8996	(98)	
Space heating efficiency (main heating system 1)	93.8000	93.8000	93.8000	93.8000	93.8000	0.0000	0.0000	0.0000	0.0000	93.8000	93.8000	93.8000	(210)	
Space heating fuel (main heating system)	1222.0431	949.0279	718.3251	368.0495	155.1094	0.0000	0.0000	0.0000	0.0000	354.3478	788.5807	1239.7650	(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 (217)m	88.8960	88.6896	88.0795	86.8018	84.5818	80.1000	80.1000	80.1000	80.1000	86.6143	88.2977	88.9558	(216)	
Fuel for water heating, kWh/month	246.2246	217.5388	230.0716	209.3155	210.5326	198.6846	190.8537	209.3729	208.9866	217.5162	225.5720	240.1506	(219)	
Water heating fuel used												2604.8195	(219)	
Annual totals kWh/year														
Space heating fuel - main system													5795.2485 (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)													446.9894 (232)	
Total delivered energy for all uses													8922.0574 (238)	

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5795.2485	3.6300	210.3675 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2604.8195	3.6300	94.5549 (247)
Pumps and fans for heating	75.0000	19.4400	14.5800 (249)
Energy for lighting	446.9894	19.4400	86.8947 (250)
Additional standing charges			95.0000 (251)
Total energy cost			501.3972 (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	5795.2485	0.2160	1251.7737 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2604.8195	0.2160	562.6410 (264)
Space and water heating			1814.4147 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	446.9894	0.5190	231.9875 (268)
Total kg/year			2085.3272 (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	5795.2485	1.2200	7070.2032 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2604.8195	1.2200	3177.8798 (264)
Space and water heating			10248.0830 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	446.9894	3.0700	1372.2574 (268)
Primary energy kWh/year			11850.5904 (272)
Primary energy kWh/m2/year			99.5848 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



FALCON
ENERGY
LIMITED

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

Current energy efficiency rating: B 81
Current environmental impact rating: B 81

(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	+ 1.4	-£ 41	-276 kg (13.2%)
U Solar photovoltaic panels	+ 8.1	-£ 398	-1063 kg (58.8%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£41	2.32 kg/m²	B 83 B 83
Solar photovoltaic panels	£398	8.94 kg/m²	B 91 B 90
Total Savings	£439	11.26 kg/m²	

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

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	£101	£111	-£10
Mains gas	£400	£349	£51
Space heating	£320	£321	-£1
Water heating	£95	£52	£42
Lighting	£87	£87	£0
Generated (PV)	-£10	-£398	£398
Total cost of fuels	£501	£62	£439
Total cost of uses	£502	£62	£439
Delivered energy	75 kWh/m²	46 kWh/m²	29 kWh/m²
Carbon dioxide emissions	2.1 tonnes	0.7 tonnes	1.3 tonnes
CO2 emissions per m²	18 kg/m²	6 kg/m²	11 kg/m²
Primary energy	100 kWh/m²	34 kWh/m²	66 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



FALCON
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LIMITED

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)
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					4.0000
Infiltration rate					0.3420 (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) =	0.3164 (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	0.4034	0.3955	0.3876	0.3480	0.3401	0.3006	0.3006	0.2927	0.3164	0.3401	0.3559	0.3718 (22b)
Effective ac	0.5814	0.5782	0.5751	0.5606	0.5578	0.5452	0.5452	0.5428	0.5501	0.5578	0.5633	0.5691 (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 = 1.30)			17.7600	1.2357	21.9468		(27)
Opening 2 Glazed Door (Uw = 1.30)			43.4300	1.2357	53.6683		(27)
Heat Loss Floor 1			74.0000	0.1800	13.3200		(28a)
External Wall 1	164.0000	61.1900	102.8100	0.1800	18.5058		(29a)
External Wall 2	36.0000		36.0000	0.0000	0.0000		(29a)
External Roof 1 Main	71.0000		71.0000	0.1800	12.7800		(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) =		120.2208		(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) =	147.8390 (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	67.5314	67.1644	66.8047	65.1150	64.7988	63.3272	63.3272	63.0546	63.8940	64.7988	65.4384	66.1070 (38)
Average = Sum(39)m / 12 =	215.3705	215.0035	214.6437	212.9540	212.6379	211.1662	211.1662	210.8937	211.7331	212.6379	213.2774	213.9460 (39)
												212.9525 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.8098	1.8068	1.8037	1.7895	1.7869	1.7745	1.7745	1.7722	1.7793	1.7869	1.7922	1.7979 (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										Total = Sum(45)m =		1606.5872 (45)
Water storage loss:	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)
Store volume												200.0000 (47)
b) If manufacturer declared loss factor is not known :												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



**FALCON
ENERGY
LIMITED**

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	29.0527	28.1155	29.0527	28.1155	29.0527	28.1155	(56)
If cylinder contains dedicated solar storage																			
18.1579	16.4007	18.1579	17.5722	18.1579	17.5722	18.1579	18.1579	17.5722	18.1579	17.5722	18.1579	17.5722	18.1579	17.5722	18.1579	17.5722	18.1579	17.5722	(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	23.2624	23.2624	23.2624	23.2624	23.2624	23.2624	(59)
Total heat required for water heating calculated for each month																			
207.9891	183.0940	190.3554	164.3927	154.3832	135.9964	128.9521	144.7165	151.4520	176.1096	188.6316	202.7332	202.7332	202.7332	202.7332	202.7332	202.7332	202.7332	202.7332	(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																			112.5000 (H13)
Daily hot water demand																			102.1100 (H14)
Volume ratio Veff/V																			1.1018 (H15)
Solar storage volume factor																			1.0000 (H16)
Solar input																			-937.0998 (H17)
Solar input	-27.1740	-45.3456	-77.2288	-103.5018	-127.8678	-125.7144	-124.0530	-108.3858	-84.8878	-57.9684	-32.2323	-22.7400	-22.7400	-22.7400	-22.7400	-22.7400	-22.7400	-22.7400	(63)
Solar input (sum of months) = Sum(63)m =																			-937.0998 (63)
Output from w/h																			
180.8150	137.7483	113.1266	60.8908	26.5154	10.2820	4.8990		36.3307	66.5643	118.1412	156.3993	179.9932	179.9932	179.9932	179.9932	179.9932	179.9932	179.9932	(64)
Total per year (kWh/year) = Sum(64)m =																			1091.7060 (64)
Heat gains from water heating, kWh/month																			
88.5204	78.3688	82.0047	70.2426	64.7151	58.0645	56.1505	61.8271	66.5713	77.2679	81.4594	86.7728	86.7728	86.7728	86.7728	86.7728	86.7728	86.7728	86.7728	(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	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)	-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)	118.9790	116.6203	110.2213	97.5592	86.9826	80.6451	75.4711	83.1010	92.4602	103.8548	113.1380	116.6301	(72)
Total internal gains	721.1975	716.1611	688.1863	640.8314	591.7412	553.3887	531.2767	541.5844	572.5194	618.6067	666.4037	701.9108	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	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	1147.2040	1535.9638	2020.6688	2580.9577	2982.2648	3009.8519	2865.8488	2535.6246	2119.0402	1585.2950	1194.7607	1054.2562	(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	15.3482	15.3744	15.4002	15.5224	15.5455	15.6538	15.6538	15.6740	15.6119	15.5455	15.4989	15.4504	
alpha	2.0232	2.0250	2.0267	2.0348	2.0364	2.0436	2.0436	2.0449	2.0408	2.0364	2.0333	2.0300	
util living area	0.9303	0.8826	0.7996	0.6699	0.5273	0.3962	0.3015	0.3476	0.5414	0.7740	0.8995	0.9399 (86)	
MIT	18.5510	18.9374	19.4951	20.0880	20.4958	20.7226	20.8096	20.7876	20.5796	19.9613	19.1288	18.4754 (87)	
Th 2	19.4631	19.4653	19.4674	19.4773	19.4792	19.4879	19.4879	19.4895	19.4845	19.4792	19.4754	19.4715 (88)	
util rest of house	0.9184	0.8638	0.7693	0.6239	0.4654	0.3166	0.2056	0.2449	0.4553	0.7272	0.8799	0.9295 (89)	
MIT 2	16.3312	16.8726	17.6397	18.4280	18.9327	19.1921	19.2710	19.2592	19.0597	18.3046	17.1619	16.2284 (90)	
Living area fraction									fLA = Living area / (4) =			0.6235 (91)	
MIT	17.7153	18.1600	18.7966	19.4630	19.9073	20.1465	20.2304	20.2122	20.0074	19.3376	18.3883	17.6294 (92)	
Temperature adjustment												-0.1500	

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

adjusted MIT 17.5653 18.0100 18.6466 19.3130 19.7573 19.9965 20.0804 20.0622 19.8574 19.1876 18.2383 17.4794 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8991	0.8417	0.7503	0.6185	0.4774	0.3445	0.2444	0.2855	0.4781	0.7168	0.8597	0.9116	(94)
Useful gains	1031.4897	1292.7728	1516.1975	1596.2745	1423.6670	1036.9146	700.5191	723.7961	1013.1930	1136.2714	1027.0878	961.0095	(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	2856.9493	2818.7058	2607.1880	2217.4984	1713.2921	1139.5485	734.9343	772.3336	1219.0318	1826.0495	2375.5477	2841.0829	(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	1358.1420	1025.4270	811.6970	447.2812	215.4811	0.0000	0.0000	0.0000	0.0000	513.1949	970.8912	1398.7746	(98)
Space heating												6740.8888	(98)
Space heating per m2												(98) / (4) =	56.6461 (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 %)													93.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													7186.4486 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1358.1420	1025.4270	811.6970	447.2812	215.4811	0.0000	0.0000	0.0000	0.0000	513.1949	970.8912	1398.7746	(98)
Space heating efficiency (main heating system 1)	93.8000	93.8000	93.8000	93.8000	93.8000	0.0000	0.0000	0.0000	0.0000	93.8000	93.8000	93.8000	(210)
Space heating fuel (main heating system)	1447.9126	1093.2057	865.3486	476.8457	229.7239	0.0000	0.0000	0.0000	0.0000	547.1161	1035.0652	1491.2309	(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	180.8150	137.7483	113.1266	60.8908	26.5154	10.2820	4.8990	36.3307	66.5643	118.1412	156.3993	179.9932	(64)
Efficiency of water heater (217)m	89.3969	89.3860	89.3402	89.3695	89.4902	80.1000	80.1000	80.1000	80.1000	88.5856	89.1478	89.4379	(217)
Fuel for water heating, kWh/month	202.2609	154.1051	126.6246	68.1338	29.6294	12.8364	6.1162	45.3567	83.1014	133.3639	175.4382	201.2494	(219)
Water heating fuel used												1238.2161	(219)
Annual totals kWh/year													
Space heating fuel - main system												7186.4486	(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)													446.9894 (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												7269.4147	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	7186.4486	3.4800	250.0884 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1238.2161	3.4800	43.0899 (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	446.9894	13.1900	58.9579 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			260.8009 (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] =	0.6679 (257)
SAP value		90.6827
SAP rating (Section 12)		91 (258)
SAP band		B

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	7186.4486	0.2160	1552.2729 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1238.2161	0.2160	267.4547 (264)
Space and water heating			1819.7276 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	446.9894	0.5190	231.9875 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			1220.1528 (272)
CO2 emissions per m2			10.2500 (273)
EI value			90.0305
EI rating			90 (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 * 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					4.0000
Infiltration rate					0.3420 (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) =	0.3164 (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	0.4429	0.4034	0.3797	0.3480	0.3639	0.3322	0.3401	0.3243	0.3480	0.3797	0.3797	0.4034 (22b)
Effective ac	0.5981	0.5814	0.5721	0.5606	0.5662	0.5552	0.5578	0.5526	0.5606	0.5721	0.5721	0.5814 (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 = 1.30)			17.7600	1.2357	21.9468		(27)
Opening 2 Glazed Door (Uw = 1.30)			43.4300	1.2357	53.6683		(27)
Heat Loss Floor 1			74.0000	0.1800	13.3200		(28a)
External Wall 1	164.0000	61.1900	102.8100	0.1800	18.5058		(29a)
External Wall 2	36.0000		36.0000	0.0000	0.0000		(29a)
External Roof 1 Main	71.0000		71.0000	0.1800	12.7800		(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) =	120.2208		(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) =	147.8390 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	69.4755	67.5314	66.4522	65.1150	65.7691	64.4900	64.7988	64.1884	65.1150	66.4522	66.4522	67.5314 (38)
Heat transfer coeff	217.3145	215.3705	214.2912	212.9540	213.6081	212.3290	212.6379	212.0274	212.9540	214.2912	214.2912	215.3705 (39)
Average = Sum(39)m / 12 =												213.9533 (39)
HLP	1.8262	1.8098	1.8008	1.7895	1.7950	1.7843	1.7869	1.7817	1.7895	1.8008	1.8008	1.8098 (40)
HLP (average)												1.7979 (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	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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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

adjusted MIT 17.9703 18.2934 18.9059 19.5044 19.8745 20.0519 20.0986 20.1013 19.9834 19.5229 18.6950 17.9269 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.8645	0.8117	0.7071	0.5582	0.4102	0.2680	0.1850	0.1876	0.3718	0.6242	0.8044	0.8810	(94)
Useful gains	1119.8091	1339.3453	1555.8428	1626.2973	1356.2747	952.1783	619.8976	556.4786	911.4773	1119.4328	1088.0535	1020.9018	(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	2666.5067	2669.1652	2465.6217	2109.1758	1553.8913	1008.9597	637.6213	572.7424	1018.6491	1569.2407	2120.4160	2590.2415	(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	1150.7430	893.6390	676.8755	347.6725	147.0267	0.0000	0.0000	0.0000	0.0000	334.6571	743.3010	1167.5888	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 45.8950 (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 %)													93.8000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5822.4985 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1150.7430	893.6390	676.8755	347.6725	147.0267	0.0000	0.0000	0.0000	0.0000	334.6571	743.3010	1167.5888	(98)
Space heating efficiency (main heating system 1)	93.8000	93.8000	93.8000	93.8000	93.8000	0.0000	0.0000	0.0000	0.0000	93.8000	93.8000	93.8000	(210)
Space heating fuel (main heating system)	1226.8049	952.7068	721.6156	370.6530	156.7449	0.0000	0.0000	0.0000	0.0000	356.7773	792.4318	1244.7642	(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	175.6528	137.4857	112.8689	56.9066	25.3197	0.0000	0.0000	27.7759	60.1925	113.8846	151.6688	176.6919	(64)
Efficiency of water heater (217)m	89.2216	89.2110	89.0990	89.1254	89.0524	80.1000	80.1000	80.1000	80.1000	87.8214	88.7900	89.2332	(216)
Fuel for water heating, kWh/month	196.8724	154.1129	126.6781	63.8500	28.4323	0.0000	0.0000	34.6765	75.1467	129.6775	170.8175	198.0113	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													5822.4985 (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)													446.9894 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 2.50 * 1281 * 0.80) =										-2048.8140		-2048.8140	(233)
Total delivered energy for all uses													5523.9491 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year	
Space heating - main system 1	5822.4985	3.6300	211.3567	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1178.2753	3.6300	42.7714	(247)
Pumps and fans for heating	75.0000	19.4400	14.5800	(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			95.0000	(251)
Energy saving/generation technologies				
PV Unit	-2048.8140	19.4400	-398.2894	(252)
Total energy cost			62.0334	(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	5822.4985	0.2160	1257.6597	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1178.2753	0.2160	254.5075	(264)
Space and water heating			1512.1671	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



FALCON
ENERGY
LIMITED

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

Energy for lighting	446.9894	0.5190	231.9875 (268)
Energy saving/generation technologies			
PV Unit	-2048.8140	0.5190	-1063.3345 (269)
Total kg/year			745.6951 (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	5822.4985	1.2200	7103.4481 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1178.2753	1.2200	1437.4959 (264)
Space and water heating			8540.9440 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	446.9894	3.0700	1372.2574 (268)
Energy saving/generation technologies			
PV Unit	-2048.8140	3.0700	-6289.8590 (269)
Primary energy kWh/year			4007.0923 (272)
Primary energy kWh/m2/year			33.6730 (273)