

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG008f		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Sem Bri Ga Ea		
Property	WP3520A+, Plot 74				
SAP Rating	84 B	DER	17.21	TERR	17.86
Environmental	36 B	% DER<TER	3.66		
CO ₂ Emissions (t/year)	1.31	DPER	47.34	TPER	50.86
General Requirements Compliance	Pass	% DPER<TPER	6.92		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 93 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.86 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.21 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 50.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.3 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency

Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 35
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

Percentage of fixed lights with low-energy fittings: 100%
Minimum 75% OK

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing East: 3.49 m², No overhang
Windows facing South: 0.60 m², No overhang
Windows facing West: 4.52 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2854 (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	0.3638	0.3567	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3210	0.3353 (22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5367	0.5367	0.5348	0.5407	0.5471	0.5515	0.5562 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5936		(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss						(33) + (36) =	60.2070 (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	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	103.7975	103.5996	103.4056	102.4946	102.3241	101.5306	101.5306	101.3837	101.8363	102.3241	102.6689	103.0294 (39)
Average = Sum(39)m / 12 =												102.4938 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1123	1.1102	1.1081	1.0983	1.0965	1.0880	1.0880	1.0864	1.0913	1.0965	1.1002	1.1040 (40)
HLP (average)												1.0983 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (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 (63)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (64)
Heat gains from water heating, kWh/month											
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869 (65)
Total per year (kWh/year) = Sum(64)m = 1700.7860 (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	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6499	22.7821	18.5276	14.0266	10.4850	8.8519	9.5648	12.4327	16.6871	21.1882	24.7297	26.3628	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	412.6191	410.0361	394.6839	370.1622	345.2579	321.6098	306.5581	313.2316	326.1523	350.8970	379.1099	400.2709	(73)

6. Solar gains

[Jan]						Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East						3.4900	19.6403	0.4400	0.0000	0.7700	23.2229 (76)	
South						0.6000	46.7521	0.4400	0.0000	0.7700	9.5038 (78)	
West						4.5200	19.6403	0.4400	0.0000	0.7700	30.0766 (80)	
Solar gains	62.8033	119.8299	191.5365	272.8370	330.2606	336.6488	321.0656	278.2531	220.4170	140.5074	77.7234	52.0430 (83)
Total gains	475.4224	529.8659	586.2205	642.9992	675.5185	658.2586	627.6237	591.4848	546.5693	491.4043	456.8333	452.3140 (84)

7. Mean internal temperature (heating season)

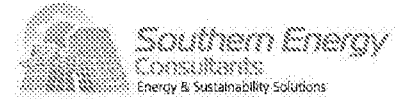
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.4705	50.5669	50.6617	51.1120	51.1972	51.5973	51.5973	51.6721	51.4424	51.1972	51.0252	50.8467
alpha	4.3647	4.3711	4.3774	4.4075	4.4131	4.4398	4.4398	4.4448	4.4295	4.4131	4.4017	4.3898
util living area	0.9974	0.9954	0.9900	0.9726	0.9242	0.8109	0.6580	0.7086	0.9019	0.9819	0.9955	0.9980 (86)
MIT	19.4943	19.6356	19.9000	20.2626	20.6073	20.8605	20.9594	20.9432	20.7481	20.3021	19.8343	19.4673 (87)
Th 2	19.9908	19.9925	19.9942	20.0022	20.0037	20.0107	20.0107	20.0119	20.0080	20.0037	20.0007	19.9975 (88)
util rest of house	0.9967	0.9941	0.9869	0.9632	0.8953	0.7358	0.5334	0.5889	0.8527	0.9741	0.9939	0.9974 (89)
MIT 2	17.9684	18.1759	18.5623	19.0912	19.5733	19.8962	19.9904	19.9805	19.7694	19.1539	18.4723	17.9334 (90)
Living area fraction	18.2924	18.4859	18.8464	19.3400	19.7929	20.1010	20.1962	20.1849	19.9773	19.3978	18.7615	18.2592 (92)
MIT	18.1424	18.3359	18.6964	19.1900	19.6429	19.9510	20.0462	20.0349	19.8273	19.2478	18.6115	18.1092 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.1092 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9946	0.9909	0.9810	0.9527	0.8820	0.7305	0.5383	0.5920	0.8413	0.9654	0.9906	0.9957 (94)
Useful gains	472.8681	525.0240	575.0717	612.5601	595.7951	480.8443	337.8235	350.1668	459.8248	474.4012	452.5376	450.3502 (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	1436.8111	1391.9560	1261.1809	1054.6704	812.7516	543.2886	349.8923	368.5238	583.2471	884.8787	1181.8767	1433.0581 (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	717.1736	582.5783	510.4653	318.3194	161.4156	0.0000	0.0000	0.0000	0.0000	305.3953	525.1242	731.1347 (98)
Space heating												3851.6064 (98)
Space heating per m2												(98) / (4) = 41.2731 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4255.9187	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	717.1736	582.5783	510.4653	318.3194	161.4156	0.0000	0.0000	0.0000	0.0000	305.3953	525.1242	731.1347	(98)	
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)	
Space heating fuel (main heating system)	792.4571	643.7329	564.0500	351.7342	178.3598	0.0000	0.0000	0.0000	0.0000	337.4534	580.2477	807.8837	(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	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)	
Efficiency of water heater (217)m	89.8589	89.8188	89.7236	89.5036	89.0187	87.3000	87.3000	87.3000	87.3000	89.4488	89.7480	89.8836	(217)	
Fuel for water heating, kWh/month	192.8715	169.2003	175.8250	155.1263	150.7494	134.2869	126.0634	142.3470	143.3625	161.1095	173.3810	187.2175	(219)	
Water heating fuel used												1911.5404	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4255.9187	(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)													452.9861	(232)
Total delivered energy for all uses													6695.4452	(238)

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

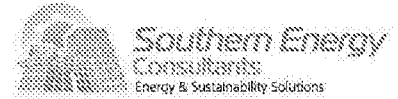
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4255.9187	0.2160	919.2784 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1911.5404	0.2160	412.8927 (264)
Space and water heating			1332.1712 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total CO2, kg/year			1606.1959 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.2100 (273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.2100	ZC1
Total Floor Area	TFA	93.3200	
Assumed number of occupants	N	2.6685	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5609	ZC2
CO2 emissions from cooking, equation (L16)		1.9615	ZC3
Total CO2 emissions		34.7324	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.7324	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3218 (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	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (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
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
Heat Loss Floor 1			46.6600	0.1300	6.0658		(28a)
Brick Cavity	96.8000	12.9100	83.8900	0.1800	15.1002		(29a)
External Roof 1	46.6600		46.6600	0.1300	6.0658		(30)
Total net area of external elements Aum(A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.3766		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7463 (36)
Total fabric heat loss						(33) + (36) =	53.1229 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922
Heat transfer coeff	98.0977	97.8460	97.5994	96.4408	96.2241	95.2150	95.2150
Average = Sum(39)m / 12 =							
HLP	1.0512	1.0485	1.0459	1.0334	1.0311	1.0203	1.0203
HLP (average)							
Days in month	31	28	31	30	31	30	31
							31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)
Energy content (annual)												Total = Sum(45)m = 1535.2611 (45)
Distribution loss (46)m = 0.15 x (45)m	23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	50.9589	46.0274	50.7185	47.1576	46.7406	43.3080	44.7516	46.7406	47.1576	50.7185	49.3151	50.9589	50.9589	50.9589	(61)
Total heat required for water heating calculated for each month	210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	205.1102	205.1102	(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	0.0000	0.0000	(63)
Output from w/h	210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	205.1102	205.1102	(64)
Heat gains from water heating, kWh/month	65.6650	57.7956	60.4455	53.4328	51.6430	45.3076	43.1393	48.3498	48.8919	55.9191	59.5280	63.9950	63.9950	63.9950	(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	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6499	22.7821	18.5276	14.0266	10.4850	8.8519	9.5648	12.4327	16.6871	21.1882	24.7297	26.3628	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	88.2594	86.0054	81.2439	74.2123	69.4127	62.9272	57.9829	64.9863	67.9055	75.1600	82.6778	86.0148	(72)
Total internal gains	424.9916	422.4126	406.9886	381.8140	356.2523	331.9489	316.9050	324.2334	337.8151	363.2126	391.4924	412.6474	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
East	3.4900				19.6403		0.6300		0.7000		0.7700		20.9481 (76)	
South	0.6000				46.7521		0.6300		0.7000		0.7700		8.5728 (78)	
West	4.5200				19.6403		0.6300		0.7000		0.7700		27.1305 (80)	
Solar gains	56.6514	108.0920	172.7747	246.1114	297.9101	303.6725	289.6158	250.9970	198.8261	126.7441	70.1101	46.9452	(83)	
Total gains	481.6430	530.5045	579.7633	627.9254	654.1624	635.6214	606.5208	575.2304	536.6412	489.9566	461.6024	459.5926	(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	66.0623	66.2322	66.3996	67.1972	67.3486	68.0623	68.0623	68.1961	67.7856	67.3486	67.0431	66.7266		
alpha	5.4042	5.4155	5.4266	5.4798	5.4899	5.5375	5.5375	5.5464	5.5190	5.4899	5.4695	5.4484		
util living area	0.9991	0.9982	0.9953	0.9842	0.9446	0.8286	0.6605	0.7122	0.9193	0.9898	0.9981	0.9993	(86)	
MIT	19.8142	19.9277	20.1402	20.4356	20.7151	20.9148	20.9811	20.9717	20.8287	20.4694	20.0926	19.7962	(87)	
Th 2	20.0409	20.0431	20.0453	20.0556	20.0575	20.0664	20.0664	20.0681	20.0630	20.0575	20.0536	20.0495	(88)	
util rest of house	0.9987	0.9975	0.9936	0.9775	0.9186	0.7516	0.5355	0.5906	0.8710	0.9843	0.9973	0.9990	(89)	
MIT 2	18.4451	18.6127	18.9245	19.3598	19.7513	20.0019	20.0585	20.0547	19.9081	19.4130	18.8617	18.4250	(90)	
Living area fraction	18.7359	18.8920	19.1827	19.5882	19.9560	20.1958	20.2544	20.2495	20.1036	19.6374	19.1232	18.7162	(91)	
Temperature adjustment												0.0000		
adjusted MIT	18.7359	18.8920	19.1827	19.5882	19.9560	20.1958	20.2544	20.2495	20.1036	19.6374	19.1232	18.7162	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9964	0.9913	0.9731	0.9152	0.7637	0.5621	0.6161	0.8736	0.9808	0.9961	0.9985	(94)
Useful gains	480.7066	528.5856	574.6979	611.0144	598.6797	485.4085	340.9332	354.4030	468.7958	480.5609	459.8150	458.9022	(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	1416.1299	1369.0596	1237.8201	1030.7837	794.4233	532.8029	347.9572	365.8082	573.9688	869.6121	1162.1894	1409.8316	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	695.9549	564.7985	493.3630	302.2339	145.6332	0.0000	0.0000	0.0000	0.0000	289.4541	505.7096	707.4915	(98)
Space heating												3704.6388	(98)
Space heating per m ²												39.6982	(99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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 %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3966.4227 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	695.9549	564.7985	493.3630	302.2339	145.6332	0.0000	0.0000	0.0000	0.0000	289.4541	505.7096	707.4915	(98)
Space heating efficiency (main heating system 1)	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)	745.1338	604.7094	528.2259	323.5909	155.9242	0.0000	0.0000	0.0000	0.0000	309.9080	541.4449	757.4855	(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	210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	(64)
Efficiency of water heater (217)m	87.8378	87.6764	87.2967	86.4504	84.7099	80.3000	80.3000	80.3000	80.3000	86.2306	87.3838	87.9147	(217)
Fuel for water heating, kWh/month	239.2280	211.2789	222.6604	199.4219	197.0426	183.0748	175.3996	195.5295	197.6889	209.6262	218.8822	233.3058	(219)
Water heating fuel used												2483.1389	(219)
Annual totals kWh/year													
Space heating fuel - main system												3966.4227	(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)												452.9861	(232)
Total delivered energy for all uses												6977.5476	(238)

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	3966.4227	0.2160	856.7473 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2483.1389	0.2160	536.3580 (264)
Space and water heating			1393.1053 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total CO2, kg/m2/year			1667.1301 (272)
Emissions per m2 for space and water heating			14.9283 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5193 (272b)
Emissions per m2 for pumps and fans			0.4171 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.9283 * 1.00) + 2.5193 + 0.4171, rounded to 2 d.p.			17.8600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3218 (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	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.5936			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			9.0000	419.9400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				18439.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							197.5932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss			(33) + (36) =				60.2070 (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	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922	41.9053	42.4808	43.1012	43.5397	43.9981 (38)
Heat transfer coeff	105.1818	104.9301	104.6835	103.5250	103.3082	102.2992	102.2992	102.1123	102.6878	103.3082	103.7467	104.2051 (39)
Average = Sum(39)m / 12 =												103.5239 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1271	1.1244	1.1218	1.1094	1.1070	1.0962	1.0962	1.0942	1.1004	1.1070	1.1117	1.1166 (40)
HLP (average)												1.1093 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.8244	29.5831	30.5271	26.6142	25.5370	22.0365	20.4200	23.4323	23.7121	27.6342	30.1649	32.7571 (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)
(66)m	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6499	22.7821	18.5276	14.0266	10.4850	8.8519	9.5648	12.4327	16.6871	21.1882	24.7297	26.3628	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	45.4629	44.0224	41.0310	36.9642	34.3239	30.6062	27.4463	31.4950	32.9335	37.1428	41.8957	44.0284	(72)
Total internal gains	379.1951	377.4296	363.7757	341.5659	318.1636	296.6279	283.3684	287.7421	299.8431	322.1953	347.7103	367.6610	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				3.4900	19.6403		0.4400		0.0000		0.7700		23.2229 (76)
South				0.6000	46.7521		0.4400		0.0000		0.7700		9.5038 (78)
West				4.5200	19.6403		0.4400		0.0000		0.7700		30.0766 (80)
Solar gains	62.8033	119.8299	191.5365	272.8370	330.2606	336.6488	321.0656	278.2531	220.4170	140.5074	77.7234	52.0430	(83)
Total gains	441.9984	497.2594	555.3122	614.4030	648.4242	633.2767	604.4340	565.9953	520.2601	462.7027	425.4337	419.7040	(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	48.6972	48.8140	48.9290	49.4765	49.5803	50.0694	50.0694	50.1610	49.8799	49.5803	49.3708	49.1536
alpha	4.2465	4.2543	4.2619	4.2984	4.3054	4.3380	4.3380	4.3441	4.3253	4.3054	4.2914	4.2769
util living area	0.9979	0.9961	0.9912	0.9756	0.9317	0.8259	0.6779	0.7303	0.9134	0.9847	0.9963	0.9983 (86)
MIT	19.4052	19.5515	19.8257	20.2049	20.5657	20.8393	20.9507	20.9312	20.7155	20.2465	19.7614	19.3819 (87)
Th 2	19.9788	19.9809	19.9831	19.9932	19.9951	20.0039	20.0039	20.0056	20.0005	19.9951	19.9913	19.9873 (88)
util rest of house	0.9973	0.9950	0.9885	0.9672	0.9051	0.7537	0.5525	0.6115	0.8685	0.9780	0.9950	0.9978 (89)
MIT 2	18.5138	18.6615	18.9362	19.3187	19.6663	19.9117	19.9865	19.9786	19.8126	19.3642	18.8793	18.4971 (90)
Living area fraction	fLA = Living area / (4) = 0.2124 (91)											
MIT	18.7031	18.8506	19.1251	19.5069	19.8573	20.1087	20.1913	20.1809	20.0044	19.5516	19.0666	18.6850 (92)
Temperature adjustment	0.0000											
adjusted MIT	18.7031	18.8506	19.1251	19.5069	19.8573	20.1087	20.1913	20.1809	20.0044	19.5516	19.0666	18.6850 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9962	0.9933	0.9854	0.9619	0.9007	0.7624	0.5783	0.6348	0.8687	0.9740	0.9933	0.9970	(94)
Useful gains	440.3214	493.9255	547.2315	591.0204	584.0182	482.8346	349.5153	359.3204	451.9339	450.6698	422.6015	418.4318	(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	1514.9486	1463.8338	1321.6417	1098.0835	842.7158	563.5393	367.3889	386.0770	606.3061	924.7760	1241.4970	1509.4137	(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	799.5226	651.7784	576.1612	365.0854	192.4710	0.0000	0.0000	0.0000	0.0000	352.7350	589.6047	811.6905	(98)
Space heating	4339.0489 (98)												
Space heating per m2	(98) / (4) = 46.4965 (99)												

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b												
Ext. temp.	Jan 4.3000	Feb 4.9000	Mar 6.5000	Apr 8.9000	May 11.7000	Jun 14.6000	Jul 16.6000	Aug 16.4000	Sep 14.1000	Oct 10.6000	Nov 7.1000	Dec 4.2000
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	961.6121	757.0138	776.0535	0.0000	0.0000	0.0000	0.0000 (100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7557	0.8378	0.8068	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	726.6432	634.2463	626.1444	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	843.0357	807.3059	764.6884	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	83.8026	128.7563	103.0767	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												315.6356 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	20.9506	32.1891	25.7692	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												78.9089 (107)
Space cooling per m2												0.8456 (108)
Energy for space heating												46.4965 (99)
Energy for space cooling												0.8456 (108)
Total												47.3420 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.3 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					3 * 10 = 30.0000 (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)					30.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3218 (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	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (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
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
Heat Loss Floor 1			46.6600	0.1300	6.0658		(28a)
Brick Cavity	96.8000	12.9100	83.8900	0.1800	15.1002		(29a)
External Roof 1	46.6600		46.6600	0.1300	6.0658		(30)
Total net area of external elements Aum(A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.3766		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7463 (36)
Total fabric heat loss						(33) + (36) =	53.1229 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922	41.9053	42.4808	43.1012	43.5397	43.9981 (38)
Heat transfer coeff	98.0977	97.8460	97.5994	96.4408	96.2241	95.2150	95.2150	95.0282	95.6037	96.2241	96.6626	97.1210 (39)
Average = Sum(39)m / 12 =												96.4398 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0512	1.0485	1.0459	1.0334	1.0311	1.0203	1.0203	1.0183	1.0245	1.0311	1.0358	1.0407 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)
Energy content (annual)												Total = Sum(45)m = 1535.2611 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.8244	29.5831	30.5271	26.6142	25.5370	22.0365	20.4200	23.4323	23.7121	27.6342	30.1649	32.7571 (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	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6499	22.7821	18.5276	14.0266	10.4850	8.8519	9.5648	12.4327	16.6871	21.1882	24.7297	26.3628	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	45.4629	44.0224	41.0310	36.9642	34.3239	30.6062	27.4463	31.4950	32.9335	37.1428	41.6957	44.0284	(72)
Total internal gains	379.1951	377.4296	363.7757	341.5659	318.1636	296.6279	283.3684	287.7421	299.8431	322.1953	347.7103	367.6610	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481 (76)
South	0.6000	46.7521	0.6300	0.7000	0.7700	8.5728 (78)
West	4.5200	19.6403	0.6300	0.7000	0.7700	27.1305 (80)

Solar gains	56.6514	108.0920	172.7747	246.1114	297.9101	303.6725	289.6158	250.9970	198.8261	126.7441	70.1101	46.9452 (83)
Total gains	435.8465	485.5216	536.5504	587.6774	616.0737	600.3004	572.9842	538.7391	498.6693	448.9394	417.8204	414.6062 (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	66.0623	66.2322	66.3996	67.1972	67.3486	68.0623	68.0623	68.1961	67.7856	67.3486	67.0431	66.7266	
alpha	5.4042	5.4155	5.4266	5.4798	5.4899	5.5375	5.5375	5.5464	5.5190	5.4899	5.4695	5.4484	
util living area	0.9994	0.9988	0.9968	0.9883	0.9560	0.8533	0.6913	0.7470	0.9379	0.9932	0.9988	0.9996	(86)
MIT	19.7675	19.8820	20.0969	20.3973	20.6853	20.8999	20.9765	20.9642	20.8023	20.4293	20.0480	19.7501	(87)
Th 2	20.0409	20.0431	20.0453	20.0556	20.0575	20.0664	20.0664	20.0681	20.0630	20.0575	20.0536	20.0495	(88)
util rest of house	0.9992	0.9984	0.9955	0.9832	0.9342	0.7808	0.5642	0.6254	0.8972	0.9894	0.9984	0.9994	(89)
MIT 2	18.9047	19.0209	19.2371	19.5434	19.8222	20.0131	20.0595	20.0561	19.9366	19.5783	19.1954	18.8944	(90)
Living area fraction													(91)
MIT	19.0880	19.2038	19.4197	19.7248	20.0055	20.2014	20.2542	20.2490	20.1205	19.7590	19.3765	19.0761	(92)
Temperature adjustment													(93)
adjusted MIT	19.0880	19.2038	19.4197	19.7248	20.0055	20.2014	20.2542	20.2490	20.1205	19.7590	19.3765	19.0761	

8. Space heating requirement

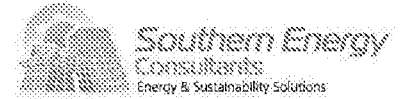
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	435.3872	484.4942	533.5517	576.3829	574.5836	475.9456	338.9629	350.8702	448.9651	443.4419	416.9221	414.2774	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1450.6654	1399.5686	1260.9531	1043.9516	799.1933	533.3393	347.9362	365.7588	575.5806	881.3181	1186.6778	1444.7868	(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	755.3670	614.9300	541.1867	336.6494	167.1097	0.0000	0.0000	0.0000	0.0000	325.7799	554.2242	766.6990	(98)
Space heating												4061.9457	(98)
Space heating per m2												43.5271	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
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	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	895.0214	704.5913	722.2142	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7985	0.8822	0.8534	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	714.6804	621.6255	616.3068	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	804.4920	770.5463	732.8305	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	64.6643	110.7971	86.6937	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												262.1550 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	16.1661	27.6993	21.6734	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												65.5388 (107)
Space cooling per m2												0.7023 (108)
Energy for space heating												43.5271 (99)
Energy for space cooling												0.7023 (108)
Total												44.2294 (109)
Target Fabric Energy Efficiency (TFEE)												50.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2854 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2996	0.2854	0.2854	0.2640	0.2640	0.2354	0.2426	0.2283	0.2354	0.2497	0.2497	0.2711 (22b)
Effective ac	0.5449	0.5407	0.5407	0.5348	0.5348	0.5277	0.5294	0.5261	0.5277	0.5312	0.5312	0.5367 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.5936		(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss						(33) + (36) =	60.2070 (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	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	102.1576	101.8363	101.8363	101.3837	101.3837	100.8351	100.9664	100.7077	100.8351	101.1016	101.1016	101.5306 (39)
Average = Sum(39)m / 12 =												101.3063 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0947	1.0913	1.0913	1.0864	1.0864	1.0805	1.0819	1.0792	1.0805	1.0834	1.0834	1.0880 (40)
HLP (average)												1.0856 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)											
Distribution loss (46)m = 0.15 x (45)m												
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227	(46)
Water storage loss:												
Total storage loss												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535	(61)
Total heat required for water heating calculated for each month												
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(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	(63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)											
Output from w/h												
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)
RHI water heating demand												
Heat gains from water heating, kWh/month												
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869	(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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794 (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)												
	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397 (71)
Water heating gains (Table 5)												
	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383 (72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W			
East				3.4900	22.3313	0.4400	0.0000	0.7700	26.4048	(76)			
South				0.6000	50.9848	0.4400	0.0000	0.7700	10.3642	(78)			
West				4.5200	22.3313	0.4400	0.0000	0.7700	34.1976	(80)			

Solar gains	70.9667	121.8718	192.2991	281.8874	332.0936	362.1527	341.6985	303.0514	239.7410	152.5581	89.9874	58.2298	(83)
Total gains	686.7813	732.0540	777.5913	829.1871	840.6950	836.6847	796.9225	767.9983	727.1465	678.1789	657.6152	657.4400	(84)

7. Mean internal temperature (heating season)

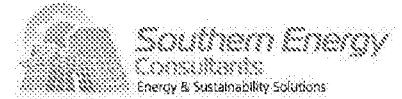
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.2806	51.4424	51.4424	51.6721	51.6721	51.9532	51.8856	52.0189	51.9532	51.8163	51.8163	51.5973
alpha	4.4187	4.4295	4.4295	4.4448	4.4448	4.4635	4.4590	4.4679	4.4635	4.4544	4.4544	4.4398
util living area	0.9870	0.9815	0.9644	0.9164	0.8014	0.5759	0.3890	0.4145	0.7187	0.9243	0.9766	0.9889 (86)
MIT	19.8640	19.9792	20.2372	20.5605	20.8349	20.9732	20.9964	20.9953	20.9251	20.6107	20.1913	19.8410 (87)
Th 2	20.0052	20.0080	20.0080	20.0119	20.0119	20.0168	20.0156	20.0179	20.0168	20.0144	20.0144	20.0107 (88)
util rest of house	0.9835	0.9764	0.9542	0.8913	0.7421	0.4741	0.2675	0.2900	0.6268	0.8959	0.9691	0.9859 (89)
MIT 2	18.5157	18.6841	19.0545	19.5080	19.8587	20.0020	20.0148	20.0168	19.9640	19.5859	18.9969	18.4865 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.8021	18.9592	19.3057	19.7316	20.0661	20.2083	20.2233	20.2246	20.1681	19.8035	19.2506	18.7742 (92)
Temperature adjustment												
adjusted MIT	18.6521	18.8092	19.1557	19.5816	19.9161	20.0583	20.0733	20.0746	20.0181	19.6535	19.1006	-0.1500
												18.6242 (93)

8. Space heating requirement

Utilisation	0.9767	0.9680	0.9427	0.8779	0.7356	0.4786	0.2747	0.2973	0.6269	0.8827	0.9595	0.9798	(94)
Useful gains	670.7961	708.6579	733.0078	727.9807	618.4258	400.4536	218.9255	228.3458	455.8738	598.6527	630.9958	644.1734	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1384.4467	1345.1757	1197.1547	981.5543	701.1747	409.2176	219.4316	229.0691	485.8348	814.2261	1122.2829	1373.1171	(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	530.9560	427.7399	345.3253	182.5730	61.5652	0.0000	0.0000	0.0000	0.0000	160.3866	353.7267	542.3341	(98)
Space heating													
RHI space heating demand													2604.6068 (98)

FULL SAP CALCULATION PRINTOUT

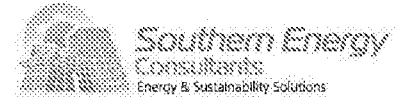
Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2854 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.3638	0.3567	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3210	0.3353 (22b)
	0.5662	0.5636	0.5611	0.5493	0.5471	0.5367	0.5367	0.5348	0.5407	0.5471	0.5515	0.5562 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5936		(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss						(33) + (36) =	60.2070 (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	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	103.7975	103.5996	103.4056	102.4946	102.3241	101.5306	101.5306	101.3837	101.8363	102.3241	102.6689	103.0294 (39)
Average = Sum(39)m / 12 =												102.4938 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1123	1.1102	1.1081	1.0983	1.0965	1.0880	1.0880	1.0864	1.0913	1.0965	1.1002	1.1040 (40)
HLP (average)												1.0983 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761 20.8822 21.5485 18.7865 18.0261 15.5552 14.4141 16.5404 16.7380 19.5065 21.2929 23.1227 (46)											
Water storage loss:											
Total storage loss											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)											
If cylinder contains dedicated solar storage											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)											
Combi loss 14.1386 12.7594 14.0997 13.6002 14.0211 13.5314 13.9591 13.9993 13.5689 14.0672 13.6535 14.1265 (61)											
Total heat required for water heating calculated for each month											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (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 (63)											
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (64)											
Heat gains from water heating, kWh/month											
56.4599 49.4786 51.2908 45.0435 43.4632 37.8634 35.4411 40.1645 40.4948 46.7562 50.6126 54.7869 (65)											
Total per year (kWh/year) = Sum(64)m = 1700.7860 (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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
East				3.4900	19.6403		0.4400		0.0000		0.7700		23.2229 (76)
South				0.6000	46.7521		0.4400		0.0000		0.7700		9.5038 (78)
West				4.5200	19.6403		0.4400		0.0000		0.7700		30.0766 (80)
Solar gains	62.8033	119.8299	191.5365	272.8370	330.2606	336.6488	321.0656	278.2531	220.4170	140.5074	77.7234	52.0430	(83)
Total gains	678.6179	730.0120	776.8287	820.1367	838.8620	811.1808	776.2896	743.2001	707.8225	666.1282	645.3512	651.2532	(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	50.4705	50.5669	50.6617	51.1120	51.1972	51.5973	51.5973	51.6721	51.4424	51.1972	51.0252	50.8467
alpha	4.3647	4.3711	4.3774	4.4075	4.4131	4.4398	4.4398	4.4448	4.4295	4.4131	4.4017	4.3898
util living area	0.9898	0.9846	0.9721	0.9387	0.8627	0.7161	0.5534	0.5955	0.8128	0.9486	0.9831	0.9914 (86)
MIT	19.7304	19.8645	20.1093	20.4359	20.7265	20.9172	20.9794	20.9714	20.8470	20.4813	20.0497	19.7000 (87)
Th 2	19.9908	19.9925	19.9942	20.0022	20.0037	20.0107	20.0107	20.0119	20.0080	20.0037	20.0007	19.9975 (88)
util rest of house	0.9871	0.9806	0.9643	0.9205	0.8204	0.6332	0.4391	0.4817	0.7441	0.9297	0.9779	0.9892 (89)
MIT 2	18.3116	18.5072	18.8614	19.3295	19.7200	19.9478	20.0012	19.9976	19.8761	19.4010	18.7831	18.2722 (90)
Living area fraction	18.6130	18.7955	19.1264	19.5645	19.9338	20.1537	20.2089	20.2044	20.0823	19.6305	19.0521	0.2124 (91)
Ext temp.	18.4630	18.6455	18.9764	19.4145	19.7838	20.0037	20.0589	20.0544	19.9323	19.4805	18.9021	18.4254 (93)
Temperature adjustment												
adjusted MIT												

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9813	0.9730	0.9538	0.9071	0.8095	0.6326	0.4450	0.4869	0.7380	0.9167	0.9698	0.9840 (94)
Useful gains	665.9022	710.2922	740.9342	743.9108	679.0555	513.1206	345.4271	361.8826	522.4061	610.6265	625.8584	640.8383 (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	1470.0803	1424.0238	1290.1332	1077.6780	827.1668	548.6391	351.1867	370.4966	593.9435	908.6875	1211.7098	1465.6372 (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	598.3085	479.6277	408.6041	240.3124	110.1948	0.0000	0.0000	0.0000	0.0000	221.7573	421.8130	613.6504 (98)
Space heating												3094.2682 (98)
Space heating per m2												(98) / (4) = 33.1576 (99)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3419.0808 (211)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
598.3085	479.6277	408.6041	240.3124	110.1948	0.0000	0.0000	0.0000	0.0000	0.0000	221.7573	421.8130	613.6504	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	661.1144	529.9753	451.4962	265.5386	121.7622	0.0000	0.0000	0.0000	0.0000	245.0357	466.0917	678.0667	(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	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)
Efficiency of water heater (217)m	89.7610	89.7088	89.5853	89.3013	88.7144	87.3000	87.3000	87.3000	87.3000	89.2120	89.6148	89.7917	(217)
Fuel for water heating, kWh/month	193.0820	169.4079	176.0963	155.4777	151.2665	134.2869	126.0634	142.3470	143.3625	161.5373	173.6388	187.4091	(219)
Water heating fuel used												1913.9754	(219)
Annual totals kWh/year													
Space heating fuel - main system													3419.0808 (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)													452.9861 (232)
Total delivered energy for all uses													5861.0423 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3419.0808	3.4800	118.9840 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1913.9754	3.4800	66.6063 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	452.9861	13.1900	59.7489 (250)
Additional standing charges			120.0000 (251)
Total energy cost			375.2317 (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] =	1.1394 (257)
SAP value		84.1058
SAP rating (Section 12)		B (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	3419.0808	0.2160	738.5215 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.9754	0.2160	413.4187 (264)
Space and water heating			1151.9401 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total kg/year			1425.9649 (272)
CO2 emissions per m2			15.2800 (273)
EI value			86.1857
EI rating			B (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8874 = 3.922$, stars = 4
Water heating environmental impact	$0.216 / 0.8874 = 0.2434$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2854 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2996	0.2854	0.2854	0.2640	0.2640	0.2354	0.2426	0.2283	0.2354	0.2497	0.2497	0.2711 (22b)
Effective ac	0.5449	0.5407	0.5407	0.5348	0.5348	0.5277	0.5294	0.5261	0.5277	0.5312	0.5312	0.5367 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.5936		(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss						(33) + (36) =	60.2070 (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	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	102.1576	101.8363	101.8363	101.3837	101.3837	100.8351	100.9664	100.7077	100.8351	101.1016	101.1016	101.5306 (39)
Average = Sum(39)m / 12 =												101.3063 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0947	1.0913	1.0913	1.0864	1.0864	1.0805	1.0819	1.0792	1.0805	1.0834	1.0834	1.0880 (40)
HLP (average)												1.0856 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761 20.8822 21.5485 18.7865 18.0261 15.5552 14.4141 16.5404 16.7380 19.5065 21.2929 23.1227 (46)											
Water storage loss:											
Total storage loss											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)											
If cylinder contains dedicated solar storage											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)											
Combi loss 14.1386 12.7594 14.0997 13.6002 14.0211 13.5314 13.9591 13.9993 13.5689 14.0672 13.6535 14.1265 (61)											
Total heat required for water heating calculated for each month											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (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											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (64)											
Heat gains from water heating, kWh/month											
56.4599 49.4786 51.2908 45.0435 43.4632 37.8634 35.4411 40.1645 40.4948 46.7562 50.6126 54.7869 (65)											
Total per year (kWh/year) = Sum(64)m = 1700.7860 (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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102	(73)

6. Solar gains

[Jan]															
					Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W		
East					3.4900	22.3313		0.4400	0.0000		0.7700		26.4048 (76)		
South					0.6000	50.9848		0.4400	0.0000		0.7700		10.3642 (78)		
West					4.5200	22.3313		0.4400	0.0000		0.7700		34.1976 (80)		
Solar gains	70.9667	121.8718	192.2991	281.8874	332.0936	362.1527	341.6985	303.0514	239.7410	152.5581	89.9874	58.2298 (83)			
Total gains	686.7813	732.0540	777.5913	829.1871	840.6950	836.6847	796.9225	767.9983	727.1465	678.1789	657.6152	657.4400 (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	51.2806	51.4424	51.4424	51.6721	51.6721	51.9532	51.8856	52.0189	51.9532	51.8163	51.8163	51.5973
alpha	4.4187	4.4295	4.4295	4.4448	4.4448	4.4635	4.4590	4.4679	4.4635	4.4544	4.4544	4.4398
util living area	0.9870	0.9815	0.9644	0.9164	0.8014	0.5759	0.3890	0.4145	0.7187	0.9243	0.9766	0.9889 (86)
MIT	19.8640	19.9792	20.2372	20.5605	20.8349	20.9732	20.9964	20.9953	20.9251	20.6107	20.1913	19.8410 (87)
Th 2	20.0052	20.0080	20.0080	20.0119	20.0119	20.0168	20.0156	20.0179	20.0168	20.0144	20.0144	20.0107 (88)
util rest of house	0.9835	0.9764	0.9542	0.8913	0.7421	0.4741	0.2675	0.2900	0.6268	0.8959	0.9691	0.9859 (89)
MIT 2	18.5157	18.6841	19.0545	19.5080	19.8587	20.0020	20.0148	20.0168	19.9640	19.5859	18.9969	18.4865 (90)
Living area fraction	18.8021	18.9592	19.3057	19.7316	20.0661	20.2083	20.2233	20.2246	20.1681	19.8035	19.2506	18.7742 (92)
Temperature adjustment	18.6521	18.8092	19.1557	19.5816	19.9161	20.0583	20.0733	20.0746	20.0181	19.6535	19.1006	-0.1500
adjusted MIT	18.6521	18.8092	19.1557	19.5816	19.9161	20.0583	20.0733	20.0746	20.0181	19.6535	19.1006	18.6242 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9767	0.9680	0.9427	0.8779	0.7356	0.4786	0.2747	0.2973	0.6269	0.8827	0.9595	0.9798 (94)
Useful gains	670.7961	708.6579	733.0078	727.9807	618.4258	400.4536	218.9255	228.3458	455.8738	598.6527	630.9958	644.1734 (95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Heat loss rate W	1384.4467	1345.1757	1197.1547	981.5543	701.1747	409.2176	219.4316	229.0691	485.8348	814.2261	1122.2829	1373.1171 (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	530.9560	427.7399	345.3253	182.5730	61.5652	0.0000	0.0000	0.0000	0.0000	160.3866	353.7267	542.3341 (98)
Space heating												2604.6068 (98)
Space heating per m2												(98) / (4) = 27.9105 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2878.0186 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	530.9560	427.7399	345.3253	182.5730	61.5652	0.0000	0.0000	0.0000	0.0000	160.3866	353.7267	542.3341	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	586.6918	472.6408	381.5749	201.7381	68.0278	0.0000	0.0000	0.0000	0.0000	177.2228	390.8583	599.2642	(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	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)
Efficiency of water heater (217)m	89.6909	89.6386	89.4716	89.0893	88.2817	87.3000	87.3000	87.3000	87.3000	88.9568	89.4978	89.7212	(216)
Fuel for water heating, kWh/month	193.2328	169.5405	176.3202	155.8477	152.0079	134.2869	126.0634	142.3470	143.3625	162.0007	173.8658	187.5563	(219)
Water heating fuel used												1916.4316	(219)
Annual totals kWh/year													
Space heating fuel - main system													2878.0186 (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)													452.9861 (232)
Total delivered energy for all uses													5322.4362 (238)

10a. Fuel costs - using BEDF prices (470)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2878.0186	3.8700	111.3793 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1916.4316	3.8700	74.1659 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	452.9861	18.9000	85.6144 (250)
Additional standing charges			93.0000 (251)
Total energy cost			378.3346 (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	2878.0186	0.2160	621.6520 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.4316	0.2160	413.9492 (264)
Space and water heating			1035.6012 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total kg/year			1309.6260 (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	2878.0186	1.2200	3511.1827 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.4316	1.2200	2338.0465 (264)
Space and water heating			5849.2292 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	452.9861	3.0700	1390.6672 (268)
Primary energy kWh/year			7470.1464 (272)
Primary energy kWh/m2/year			80.0487 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(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	+ 1.2	-£ 29	-188 kg (14.3%)
U Solar photovoltaic panels	+ 9.7	-£ 345	-947 kg (84.4%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.01 kg/m²	B 85 B 88
Solar photovoltaic panels	£345	10.15 kg/m²	A 95 A 97
Total Savings	£374	12.15 kg/m²	

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 97

Fuel prices for cost data on this page from database revision number 470 TEST (21 Dec 2020)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£100	£109	-£9
Mains gas	£279	£240	£38
Space heating	£219	£219	£0
Water heating	£74	£45	£29
Lighting	£86	£86	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£379	£4	£374
Total cost of uses	£379	£5	£374
Delivered energy	57 kWh/m²	27 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	2 kg/m²	12 kg/m²
Primary energy	80 kWh/m²	9 kWh/m²	71 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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) =					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2854 (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	0.3638	0.3567	0.3496	0.3139	0.3068	0.2711	0.2711	0.2640	0.2854	0.3068	0.3210	0.3353 (22b)
Effective ac	0.5662	0.5636	0.5611	0.5493	0.5471	0.5367	0.5367	0.5348	0.5407	0.5471	0.5515	0.5562 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.5936			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss							(33) + (36) = 60.2070 (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	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	103.7975	103.5996	103.4056	102.4946	102.3241	101.5306	101.5306	101.3837	101.8363	102.3241	102.6689	103.0294 (39)
Average = Sum(39)m / 12 =												102.4938 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1123	1.1102	1.1081	1.0983	1.0965	1.0880	1.0880	1.0864	1.0913	1.0965	1.1002	1.1040 (40)
HLP (average)												1.0983 (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												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

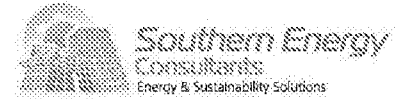
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1079.5246 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											1813.6014 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.1813 (H8)
Collector performance factor											0.5711 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											97.5767 (H14)
Solar storage volume factor											0.7686 (H15)
Solar input											0.9474 (H16)
Solar input	-25.0192	-41.7499	-71.1048	-95.2945	-117.7283	-115.7457	-114.2161	-99.7912	-78.1565	-53.3717	-29.6764 (H17)
Output from w/h											-862.7912 (H17)
148.2931	110.2239	86.6516	43.5492	16.4668	1.4867	0.0000	24.4777	46.9990	90.7389	125.9296	147.3410 (64)
Heat gains from water heating, kWh/month											
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	842.1575 (64)
54.7869											

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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W

East	3.4900	19.6403	0.4400	0.0000	0.7700	23.2229 (76)
South	0.6000	46.7521	0.4400	0.0000	0.7700	9.5038 (78)
West	4.5200	19.6403	0.4400	0.0000	0.7700	30.0766 (80)

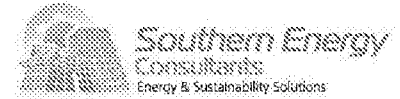
Solar gains	62.8033	119.8299	191.5365	272.8370	330.2606	336.6488	321.0656	278.2531	220.4170	140.5074	77.7234	52.0430 (83)
Total gains	678.6179	730.0120	776.8287	820.1367	838.8620	811.1808	776.2896	743.2001	707.8225	666.1282	645.3512	651.2532 (84)

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	50.4705	50.5669	50.6617	51.1120	51.1972	51.5973	51.5973	51.6721	51.4424	51.1972	51.0252	50.8467	
alpha	4.3647	4.3711	4.3774	4.4075	4.4131	4.4398	4.4398	4.4448	4.4295	4.4131	4.4017	4.3898	
util living area													
	0.9898	0.9846	0.9721	0.9387	0.8627	0.7161	0.5534	0.5955	0.8128	0.9486	0.9831	0.9914 (86)	
MIT	19.7304	19.8645	20.1093	20.4359	20.7265	20.9172	20.9794	20.9714	20.8470	20.4813	20.0497	19.7000 (87)	
Th 2	19.9908	19.9925	19.9942	20.0022	20.0037	20.0107	20.0107	20.0119	20.0080	20.0037	20.0007	19.9975 (88)	
util rest of house													
	0.9871	0.9806	0.9643	0.9205	0.8204	0.6332	0.4391	0.4817	0.7441	0.9297	0.9779	0.9892 (89)	
MIT 2	18.3116	18.5072	18.8614	19.3295	19.7200	19.9478	20.0012	19.9976	19.8761	19.4010	18.7831	18.2722 (90)	
Living area fraction										fLA = Living area / (4) =			0.2124 (91)
MIT	18.6130	18.7955	19.1264	19.5645	19.9338	20.1537	20.2089	20.2044	20.0823	19.6305	19.0521	18.5754 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.4630	18.6455	18.9764	19.4145	19.7838	20.0037	20.0589	20.0544	19.9323	19.4805	18.9021	18.4254 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9813	0.9730	0.9538	0.9071	0.8095	0.6326	0.4450	0.4869	0.7380	0.9167	0.9698	0.9840	(94)
Useful gains	665.9022	710.2922	740.9342	743.9108	679.0555	513.1206	345.4271	361.8826	522.4061	610.6265	625.8584	640.8383	(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	1470.0803	1424.0238	1290.1332	1077.6780	827.1668	548.6391	351.1867	370.4966	593.9435	908.6875	1211.7098	1465.6372	(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	598.3085	479.6277	408.6041	240.3124	110.1948	0.0000	0.0000	0.0000	0.0000	221.7573	421.8130	613.6504	(98)
Space heating												3094.2682	(98)
Space heating per m2											(98) / (4) =	33.1576	(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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3419.0808 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	598.3085	479.6277	408.6041	240.3124	110.1948	0.0000	0.0000	0.0000	0.0000	221.7573	421.8130	613.6504	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	661.1144	529.9753	451.4962	265.5386	121.7622	0.0000	0.0000	0.0000	0.0000	245.0357	466.0917	678.0667	(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	148.2931	110.2239	86.6516	43.5492	16.4668	1.4867	0.0000	24.4777	46.9990	90.7389	125.9296	147.3410	(64)
Efficiency of water heater	89.8459	89.8843	89.9233	89.9939	90.0708	87.3000	87.3000	87.3000	87.3000	89.5469	89.7437	89.8622	(217)
Fuel for water heating, kWh/month	165.0528	122.6286	96.3617	48.3912	18.2821	1.7030	0.0000	28.0386	53.8362	101.3311	140.3214	163.9632	(219)
Water heating fuel used												939.9099	(219)
Annual totals kWh/year													
Space heating fuel - main system												3419.0808	(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)													452.9861 (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												3209.7374	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3419.0808	3.4800	118.9840 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	939.9099	3.4800	32.7089 (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	452.9861	13.1900	59.7489 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			120.1064 (255)

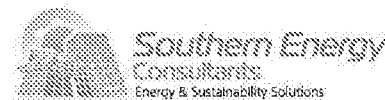
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3647 (257)
SAP value		94.9125
SAP rating (Section 12)		95 (258)
SAP band		A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3419.0808	0.2160	738.5215 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	939.9099	0.2160	203.0205 (264)
Space and water heating			941.5420 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			345.0795 (272)
CO2 emissions per m2			3.7000 (273)
EI value			96.6570
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (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					2 * 10 = 20.0000 (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)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2854 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.2996	0.2854	0.2854	0.2640	0.2640	0.2354	0.2426	0.2283	0.2354	0.2497	0.2497	0.2711 (22b)
Effective ac	0.5449	0.5407	0.5407	0.5348	0.5348	0.5277	0.5294	0.5261	0.5277	0.5312	0.5312	0.5367 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.5936			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	18859.3400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss			(33) + (36) =	60.2070			(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	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	102.1576	101.8363	101.8363	101.3837	101.3837	100.8351	100.9664	100.7077	100.8351	101.1016	101.1016	101.5306 (39)
Average = Sum(39)m / 12 =												101.3063 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0947	1.0913	1.0913	1.0864	1.0864	1.0805	1.0819	1.0792	1.0805	1.0834	1.0834	1.0880 (40)
HLP (average)												1.0856 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

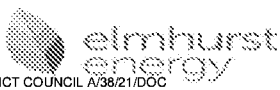
Assumed occupancy												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16



FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-27.0774	-40.6973	-68.5395	-94.7425	-114.1018	-120.0872	-117.2037	-104.6636	-81.6903	-55.5724	-32.9133
Solar input (sum of months) = Sum(63)m =											
Output from w/h	146.2349	111.2764	89.2170	44.1012	20.0933	0.0000	0.0000	19.6053	43.4651	88.5382	122.6927
Heat gains from water heating, kWh/month	56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126

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	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(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)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.4900	22.3313	0.4400	0.0000	0.7700	26.4048 (76)
South	0.6000	50.9848	0.4400	0.0000	0.7700	10.3642 (78)
West	4.5200	22.3313	0.4400	0.0000	0.7700	34.1976 (80)

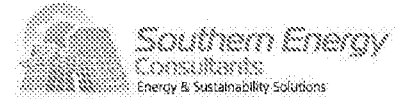
Solar gains	70.9667	121.8718	192.2991	281.8874	332.0936	362.1527	341.6985	303.0514	239.7410	152.5581	89.9874	58.2298 (83)
Total gains	686.7813	732.0540	777.5913	829.1871	840.6950	836.6847	796.9225	767.9983	727.1465	678.1789	657.6152	657.4400 (84)

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	51.2806	51.4424	51.4424	51.6721	51.6721	51.9532	51.8856	52.0189	51.9532	51.8163	51.8163	51.5973
alpha	4.4187	4.4295	4.4295	4.4448	4.4448	4.4635	4.4590	4.4679	4.4635	4.4544	4.4544	4.4398
util living area												
	0.9870	0.9815	0.9644	0.9164	0.8014	0.5759	0.3890	0.4145	0.7187	0.9243	0.9766	0.9889 (86)
MIT	19.8640	19.9792	20.2372	20.5605	20.8349	20.9732	20.9964	20.9953	20.9251	20.6107	20.1913	19.8410 (87)
Th 2	20.0052	20.0080	20.0080	20.0119	20.0119	20.0168	20.0156	20.0179	20.0168	20.0144	20.0144	20.0107 (88)
util rest of house												
	0.9835	0.9764	0.9542	0.8913	0.7421	0.4741	0.2675	0.2900	0.6268	0.8959	0.9691	0.9859 (89)
MIT 2	18.5157	18.6841	19.0545	19.5080	19.8587	20.0020	20.0148	20.0168	19.9640	19.5859	18.9969	18.4865 (90)
Living area fraction									fLA = Living area / (4) =			0.2124 (91)
MIT	18.8021	18.9592	19.3057	19.7316	20.0661	20.2083	20.2233	20.2246	20.1681	19.8035	19.2506	18.7742 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6521	18.8092	19.1557	19.5816	19.9161	20.0583	20.0733	20.0746	20.0181	19.6535	19.1006	18.6242 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of EPC Costs, Emissions and Primary Energy for Improved Dwelling 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9767	0.9680	0.9427	0.8779	0.7356	0.4786	0.2747	0.2973	0.6269	0.8827	0.9595	0.9798	(94)
Useful gains	670.7961	708.6579	733.0078	727.9807	618.4258	400.4536	218.9255	228.3458	455.8738	598.6527	630.9958	644.1734	(95)
Ext temp.	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Heat loss rate W	1384.4467	1345.1757	1197.1547	981.5543	701.1747	409.2176	219.4316	229.0691	485.8348	814.2261	1122.2829	1373.1171	(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	530.9560	427.7399	345.3253	182.5730	61.5652	0.0000	0.0000	0.0000	0.0000	160.3866	353.7267	542.3341	(98)
Space heating												2604.6068	(98)
Space heating per m2												(98) / (4) =	27.9105 (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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2878.0186 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	530.9560	427.7399	345.3253	182.5730	61.5652	0.0000	0.0000	0.0000	0.0000	160.3866	353.7267	542.3341	(98)
Space heating efficiency (main heating system 1)	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)	586.6918	472.6408	381.5749	201.7381	68.0278	0.0000	0.0000	0.0000	0.0000	177.2228	390.8583	599.2642	(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	146.2349	111.2764	89.2170	44.1012	20.0933	0.0000	0.0000	19.6053	43.4651	88.5382	122.6927	145.8440	(64)
Efficiency of water heater	89.7893	89.8203	89.8240	89.8592	89.6910	87.3000	87.3000	87.3000	87.3000	89.3353	89.6537	89.8024	(217)
Fuel for water heating, kWh/month	162.8645	123.8878	99.3242	49.0781	22.4028	0.0000	0.0000	22.4574	49.7883	99.1077	136.8518	162.4054	(219)
Water heating fuel used												928.1681	(219)
Annual totals kWh/year													
Space heating fuel - main system													2878.0186 (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)													452.9861 (232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)
Total delivered energy for all uses													2560.0131 (238)

10a. Fuel costs - using BEDF prices (470)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2878.0186	3.8700	111.3793	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	928.1681	3.8700	35.9201	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	452.9861	18.9000	85.6144	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			4.7726	(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	2878.0186	0.2160	621.6520	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	928.1681	0.2160	200.4843	(264)
Space and water heating			822.1363	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	452.9861	0.5190	235.0998	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

Regs Region: England

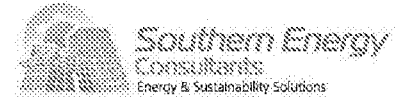
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Total kg/year

175.3722 (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	2878.0186	1.2200	3511.1827 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	928.1681	1.2200	1132.3651 (264)
Space and water heating			4643.5477 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	452.9861	3.0700	1390.6672 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			817.7948 (272)
Primary energy kWh/m2/year			8.7633 (273)

SAP 2012 OVERHEATING ASSESSMENT FOR New Build (As Designed) 9.92

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	202.1 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	307.96 (P1)
Transmission heat loss coefficient	60.21 (37)
Summer heat loss coefficient	368.16 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

Solar shading	Z blinds	Solar access	Z overhangs	Z summer
Orientation				
East	1.000	0.90	1.000	0.900 (P8)
South	1.000	0.90	1.000	0.900 (P8)
West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.4900	117.5071	0.4400	0.0000	0.9000	162.3995
South	0.6000	112.2060	0.4400	0.0000	0.9000	26.6601
West	4.5200	117.5071	0.4400	0.0000	0.9000	210.3283

total: 399.3879

	Jun	Jul	Aug	
Solar gains	423	399	354	(P4)
Internal gains	472	452	462	
Total summer gains	895	852	816	(P5)

Summer gain/loss ratio	2.43	2.31	2.22	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 202.1)	0.59	0.59	0.59	
Threshold temperature	19.02	20.80	20.60	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight