

FULL SAP CALCULATION PRINTOUT

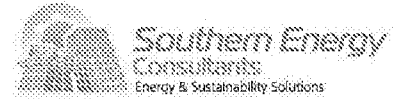
Calculation Type: New Build (As Designed)



Property Reference	SECANG002b			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Coniston, Plot 19				
SAP Rating	84 B	DER	16.61	TERR	17.23
Environmental	36 B	% DER<TER	3.59		
CO ₂ Emissions (t/year)	1.52	DPER	49.94	TPER	54.33
General Requirements Compliance	Pass	% DPER<TPER	8.07		
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

Detached House, total floor area 112 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) 17.23 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.61 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.9 kWh/m²/yrOK

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	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (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:

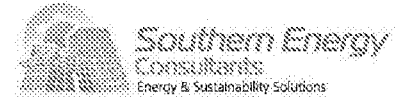
Overshading: Average
Windows facing North: 8.32 m², No overhang
Windows facing East: 0.60 m², No overhang
Windows facing South: 7.30 m², No overhang
Windows facing West: 0.60 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.037 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	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) =	0.1104 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3604 (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) =		0.3063 (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	0.3906	0.3829	0.3752	0.3370	0.3293	0.2910	0.2910	0.2833	0.3063	0.3293	0.3446	0.3599 (22b)
Effective ac	0.5763	0.5733	0.5704	0.5568	0.5542	0.5423	0.5423	0.5401	0.5469	0.5542	0.5594	0.5648 (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)			16.8200	1.2357	20.7852		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			55.8100	0.1900	10.6039	75.0000	4185.7500 (28a)
Brick Cavity	146.1000	21.1200	124.9800	0.2500	31.2450	60.0000	7498.8000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Total net area of external elements Aum (A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2232		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21530.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.8880 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4484 (36)
Total fabric heat loss (33) + (36) = 84.6716 (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	51.6868	51.4212	51.1608	49.9378	49.7090	48.6439	48.6439	48.4466	49.0541	49.7090	50.1719	50.6558 (38)
Heat transfer coeff	136.3584	136.0928	135.8324	134.6094	134.3806	133.3155	133.3155	133.1182	133.7257	134.3806	134.8435	135.3274 (39)
Average = Sum(39)m / 12 =												134.6083 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2216	1.2193	1.2169	1.2060	1.2039	1.1944	1.1944	1.1926	1.1980	1.2039	1.2081	1.2124 (40)
HLP (average)												1.2060 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.4024	107.3514	103.3004	99.2494	95.1984	91.1474	91.1474	95.1984	99.2494	103.3004	107.3514	111.4024 (44)
Energy conte	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
Energy content (annual)										Total = Sum(45)m =		1593.4492 (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

Distribution loss (46)m = 0.15 x (45)m	24.7810	21.6736	22.3652	19.4985	18.7093	16.1447	14.9605	17.1673	17.3724	20.2458	22.0999	23.9991 (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	14.1531	12.7721	14.1144	13.6224	14.0415	13.5482	13.9747	14.0180	13.5887	14.0805	13.6664	14.1405 (61)
Total heat required for water heating calculated for each month	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (64)
Heat gains from water heating, kWh/month	58.4695	51.2362	53.1049	46.6274	44.9827	39.1745	36.6560	41.5588	41.9059	48.3984	52.4047	56.7331 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1759.1698 (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	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7844	22.9014	18.6247	14.1001	10.5400	8.8983	9.6149	12.4979	16.7746	21.2992	24.8593	26.5010 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.8633	276.7051	269.5437	254.2981	235.0531	216.9656	204.8821	202.0402	209.2016	224.4472	243.6922	261.7797 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210 (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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683 (71)
Water heating gains (Table 5)	78.5880	76.2443	71.3775	64.7603	60.4606	54.4091	49.2689	55.8586	58.2027	65.0516	72.7843	76.2541 (72)
Total internal gains	446.5987	444.2140	427.9091	401.5215	374.4169	348.6361	332.1290	338.7598	352.5420	379.1611	409.6989	432.8979 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g	Specific data or Table 6b	FF	Specific data or Table 6c	Access factor Table 6d	Gains W	
North				8.3200	10.6334		0.4400		0.0000	0.7700	29.9736 (74)	
East				0.6000	19.6403		0.4400		0.0000	0.7700	3.9925 (76)	
South				7.3000	46.7521		0.4400		0.0000	0.7700	115.6291 (78)	
West				0.6000	19.6403		0.4400		0.0000	0.7700	3.9925 (80)	
Solar gains	153.5876	262.2719	364.2834	466.4977	540.6926	545.9430	522.4493	464.9253	398.9336	290.9743	183.9924	131.4680 (83)
Total gains	600.1863	706.4859	792.1925	868.0192	915.1095	894.5791	854.5782	803.6851	751.4756	670.1355	593.6914	564.3660 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (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	43.8594	43.9450	44.0293	44.4293	44.5049	44.8605	44.8605	44.9270	44.7229	44.5049	44.3522	44.1936
alpha	3.9240	3.9297	3.9353	3.9620	3.9670	3.9907	3.9907	3.9951	3.9815	3.9670	3.9568	3.9462
util living area	0.9961	0.9920	0.9832	0.9596	0.9012	0.7803	0.6298	0.6795	0.8720	0.9711	0.9927	0.9969 (86)
MIT	19.3026	19.4930	19.7953	20.1929	20.5687	20.8422	20.9508	20.9326	20.7283	20.2422	19.6974	19.2673 (87)
Th 2	19.9027	19.9046	19.9065	19.9152	19.9169	19.9245	19.9245	19.9259	19.9216	19.9169	19.9136	19.9101 (88)
util rest of house	0.9950	0.9898	0.9783	0.9466	0.8660	0.6984	0.4997	0.5536	0.8131	0.9592	0.9904	0.9961 (89)
MIT 2	17.6372	17.9159	18.3564	18.9332	19.4536	19.7978	19.9005	19.8895	19.6724	19.0115	18.2211	17.5903 (90)
Living area fraction	17.8356	18.1038	18.5278	19.0833	19.5865	19.9223	20.0256	20.0138	19.7982	19.1582	18.3970	0.1192 (91)
MIT	17.8356	18.1038	18.5278	19.0833	19.5865	19.9223	20.0256	20.0138	19.7982	19.1582	18.3970	17.7901 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6856	17.9538	18.3778	18.9333	19.4365	19.7723	19.8756	19.8638	19.6482	19.0082	18.2470	17.6401 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9914	0.9838	0.9681	0.9302	0.8462	0.6848	0.4932	0.5454	0.7941	0.9446	0.9845	0.9932 (94)
Ext temp.	595.0396	695.0081	766.8953	807.4486	774.3333	612.6474	421.5075	438.3226	596.7629	633.0382	584.4993	560.5115 (95)
Heat loss rate W	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)
Month fracti	1825.2422	1776.5275	1613.3913	1350.5706	1039.6360	689.5457	436.6914	461.0958	741.9376	1129.8951	1503.1041	1818.8179 (97)
Space heating kWh	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 per m ²	915.2708	726.7810	629.7930	391.0479	197.3852	0.0000	0.0000	0.0000	0.0000	369.6615	661.3954	936.1800 (98)
Space heating												4827.5147 (98)
Space heating per m ²												43.2495 (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													5334.2704 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	915.2708	726.7810	629.7930	391.0479	197.3852	0.0000	0.0000	0.0000	0.0000	369.6615	661.3954	936.1800	(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)	1011.3489	803.0729	695.9039	432.0971	218.1052	0.0000	0.0000	0.0000	0.0000	408.4657	730.8237	1034.4530	(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	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343	(64)
Efficiency of water heater (217)m	89.9597	89.9137	89.8224	89.6176	89.1510	87.3000	87.3000	87.3000	87.3000	89.5567	89.8552	89.9827	(217)
Fuel for water heating, kWh/month	199.3778	174.9041	181.7097	160.2505	155.6577	138.8084	130.2533	147.1558	148.2297	166.4338	179.1761	193.5197	(219)
Water heating fuel used												1975.4766	(219)
Annual totals kWh/year													
Space heating fuel - main system												5334.2704	(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)												455.3599	(232)
Total delivered energy for all uses												7840.1069	(238)

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

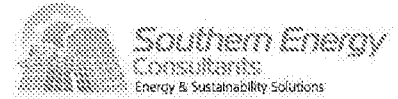
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5334.2704	0.2160	1152.2024 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1975.4766	0.2160	426.7030 (264)
Space and water heating			1578.9054 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.3599	0.5190	236.3318 (268)
Total CO2, kg/year			1854.1621 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6100 (273)

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

DER			16.6100 ZC1
Total Floor Area		TFA	111.6200
Assumed number of occupants		N	2.8242
CO2 emission factor in Table 12 for electricity displaced from grid		EF	0.5190
CO2 emissions from appliances, equation (L14)			14.5391 ZC2
CO2 emissions from cooking, equation (L16)			1.6734 ZC3
Total CO2 emissions			32.8225 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			32.8225 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1472 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3972 (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) =	0.3376 (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	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967 (22b)
Effective ac	0.5926	0.5890	0.5855	0.5690	0.5659	0.5514	0.5514	0.5488	0.5570	0.5659	0.5721	0.5787 (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)			16.8200	1.3258	22.2992		(27)
Heat Loss Floor 1			55.8100	0.1300	7.2553		(28a)
Brick Cavity	146.1000	21.1200	124.9800	0.1800	22.4964		(29a)
Main Plane	55.8100		55.8100	0.1300	7.2553		(30)
Total net area of external elements Aum(A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.0362		(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)							11.6310 (36)
Total fabric heat loss						(33) + (36) =	75.6672 (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	53.1549	52.8322	52.5160	51.0306	50.7527	49.4589	49.4589	49.2193	49.9572	50.7527	51.3149	51.9027 (38)
Heat transfer coeff	128.8221	128.4995	128.1832	126.6978	126.4199	125.1261	125.1261	124.8866	125.6245	126.4199	126.9821	127.5699 (39)
Average = Sum(39)m / 12 =												126.6965 (39)
HLP	1.1541	1.1512	1.1484	1.1351	1.1326	1.1210	1.1210	1.1189	1.1255	1.1326	1.1376	1.1429 (40)
HLP (average)												1.1351 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
Daily hot water use	111.4024	107.3514	103.3004	99.2494	95.1984	91.1474	91.1474	95.1984	99.2494	103.3004	107.3514	111.4024 (44)
Energy conte	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
Energy content (annual)										Total = Sum(45)m =		1593.4492 (45)
Distribution loss (46)m = 0.15 x (45)m	24.7810	21.6736	22.3652	19.4985	18.7093	16.1447	14.9605	17.1673	17.3724	20.2458	22.0999	23.9991 (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)

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 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 (57)
Combi loss	50.9589	46.0274	50.9589	48.9449	48.5121	44.9494	46.4477	48.5121	48.9449	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	216.1655	190.5181	200.0604	178.9352	173.2409	152.5809	146.1841	162.9610	164.7608	185.9311	196.6478	210.9527 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	216.1655	190.5181	200.0604	178.9352	173.2409	152.5809	146.1841	162.9610	164.7608	185.9311	196.6478	210.9527 (64)
Heat gains from water heating, kWh/month	67.6709	59.5500	62.3160	55.4580	53.6003	47.0248	44.7743	50.1823	50.7450	57.6180	61.3169	65.9377 (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	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7844	22.9014	18.6247	14.1001	10.5400	8.8983	9.6149	12.4979	16.7746	21.2992	24.8593	26.5010 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.8633	276.7051	269.5437	254.2981	235.0531	216.9656	204.8821	202.0402	209.2016	224.4472	243.6922	261.7797 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210 (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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683 (71)
Water heating gains (Table 5)	90.9555	88.6161	83.7580	77.0250	72.0435	65.3122	60.1805	67.4493	70.4792	77.4435	85.1623	88.6259 (72)
Total internal gains	458.9663	456.5858	440.2896	413.7863	385.9997	359.5393	343.0406	350.3505	364.8184	391.5531	422.0769	445.2697 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W		
North					8.3200	10.6334	0.6300	0.7000	0.7700	27.0375 (74)		
East					0.6000	19.6403	0.6300	0.7000	0.7700	3.6014 (76)		
South					7.3000	46.7521	0.6300	0.7000	0.7700	104.3027 (78)		
West					0.6000	19.6403	0.6300	0.7000	0.7700	3.6014 (80)		
Solar gains	138.5430	236.5812	328.6002	420.8021	487.7293	492.4654	471.2730	419.3838	359.8562	262.4721	165.9695	118.5902 (83)
Total gains	597.5093	693.1670	768.8898	834.5884	873.7290	852.0047	814.3136	769.7343	724.6747	654.0251	588.0465	563.8598 (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	60.1713	60.3223	60.4712	61.1801	61.3146	61.9486	61.9486	62.0674	61.7029	61.3146	61.0432	60.7619
alpha	5.0114	5.0215	5.0314	5.0787	5.0876	5.1299	5.1299	5.1378	5.1135	5.0876	5.0695	5.0508
util living area	0.9988	0.9973	0.9931	0.9787	0.9321	0.8099	0.6438	0.6958	0.9014	0.9854	0.9975	0.9991 (86)
MIT	19.6930	19.8412	20.0783	20.3957	20.6951	20.9063	20.9777	20.9671	20.8195	20.4342	20.0062	19.6690 (87)
Th 2	19.9569	19.9592	19.9615	19.9723	19.9743	19.9837	19.9837	19.9855	19.9801	19.9743	19.9702	19.9660 (88)
util rest of house	0.9984	0.9963	0.9904	0.9697	0.9010	0.7256	0.5111	0.5661	0.8443	0.9776	0.9964	0.9988 (89)
MIT 2	18.2078	18.4259	18.7732	19.2389	19.6543	19.9151	19.9748	19.9706	19.8231	19.2997	18.6754	18.1791 (90)
Living area fraction	18.3848	18.5945	18.9287	19.3767	19.7783	20.0332	20.0943	20.0893	19.9418	19.4349	18.8339	18.3567 (92)
MIT	18.3848	18.5945	18.9287	19.3767	19.7783	20.0332	20.0943	20.0893	19.9418	19.4349	18.8339	18.3567 (93)
Temperature adjustment												0.0000
adjusted MIT	18.3848	18.5945	18.9287	19.3767	19.7783	20.0332	20.0943	20.0893	19.9418	19.4349	18.8339	18.3567 (93)

8. Space heating requirement

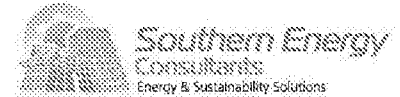
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9974	0.9943	0.9866	0.9626	0.8935	0.7303	0.5265	0.5806	0.8417	0.9717	0.9945	0.9981 (94)
Ext temp.	595.9749	689.2475	758.5819	803.3748	780.6623	622.2524	428.7031	446.9117	609.9291	635.5065	584.8402	562.7743 (95)
Heat loss rate W	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)
Month fracti	1814.4290	1759.7415	1593.1498	1327.3790	1021.2614	679.8356	437.2251	460.7465	733.8764	1116.9016	1490.0005	1805.9649 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	906.5298	719.3720	620.9185	377.2830	179.0057	0.0000	0.0000	0.0000	0.0000	358.1579	651.7154	924.9338 (98)
Space heating per m2												4737.9162 (98)
										(98) / (4) =		42.4468 (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

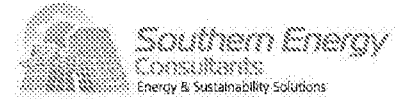
Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5072.7154 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	906.5298	719.3720	620.9185	377.2830	179.0057	0.0000	0.0000	0.0000	0.0000	358.1579	651.7154	924.9338 (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)	970.5887	770.2056	664.7949	403.9433	191.6550	0.0000	0.0000	0.0000	0.0000	383.4667	697.7681	990.2931 (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	216.1655	190.5181	200.0604	178.9352	173.2409	152.5809	146.1841	162.9610	164.7608	185.9311	196.6478	210.9527 (64)
Efficiency of water heater (217)m	88.2625	88.0803	87.7116	86.8844	85.1336	80.3000	80.3000	80.3000	80.3000	86.6745	87.8391	80.3000 (216)
Fuel for water heating, kWh/month	244.9121	216.3005	228.0889	205.9463	203.4929	190.0136	182.0475	202.9403	205.1815	214.5164	223.8728	88.3365 (217)
Water heating fuel used												238.8057 (219)
Annual totals kWh/year												2556.1183 (219)
Space heating fuel - main system												5072.7154 (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)												455.3599 (232)
Total delivered energy for all uses												8159.1935 (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	5072.7154	0.2160	1095.7065 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2556.1183	0.2160	552.1215 (264)
Space and water heating			1647.8281 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.3599	0.5190	236.3318 (268)
Total CO2, kg/m2/year			1923.0848 (272)
Emissions per m2 for space and water heating			14.7628 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.1173 (272b)
Emissions per m2 for pumps and fans			0.3487 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.7628 * 1.00) + 2.1173 + 0.3487, rounded to 2 d.p.			17.2300 (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	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1472 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3972 (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)	=	0.3376 (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	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967 (22b)
	0.5926	0.5890	0.5855	0.5690	0.5659	0.5514	0.5514	0.5488	0.5570	0.5659	0.5721	0.5787 (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)			16.8200	1.2357	20.7852		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			55.8100	0.1900	10.6039	75.0000	4185.7500 (28a)
Brick Cavity	146.1000	21.1200	124.9800	0.2500	31.2450	60.0000	7498.8000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Total net area of external elements Aum (A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2232		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			9.0000	502.2900 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21027.8700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 188.3880 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4484 (36)
Total fabric heat loss (33) + (36) = 84.6716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	53.1549	52.8322	52.5160	51.0306	50.7527	49.4589	49.4589	49.2193	49.9572	50.7527	51.3149	51.9027 (38)
Average = Sum(39)m / 12 =	137.8265	137.5038	137.1876	135.7022	135.4242	134.1305	134.1305	133.8909	134.6288	135.4242	135.9865	136.5742 (39)
												135.7008 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2348	1.2319	1.2291	1.2158	1.2133	1.2017	1.2017	1.1995	1.2061	1.2133	1.2183	1.2236 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.4024	107.3514	103.3004	99.2494	95.1984	91.1474	91.1474	95.1984	99.2494	103.3004	107.3514	111.4024 (44)
Energy content (annual)	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
										Total = Sum(45)m =		1593.4492 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	35.1064	30.7043	31.6841	27.6229	26.5049	22.8717	21.1940	24.3204	24.6109	28.6816	31.3082	33.9987 (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	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7844	22.9014	19.6247	14.1001	10.5400	8.8983	9.6149	12.4979	16.7746	21.2992	24.8593	26.5010	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.8633	276.7051	269.5437	254.2981	235.0531	216.9656	204.8821	202.0402	209.2016	224.4472	243.6922	261.7797	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	(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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	(71)
Water heating gains (Table 5)	47.1860	45.6909	42.5861	38.3652	35.6248	31.7662	28.4865	32.6887	34.1818	38.5505	43.4836	45.6971	(72)
Total internal gains	412.1968	410.6606	396.1177	372.1265	346.5811	322.9933	308.3466	312.5899	325.5210	349.6601	377.3982	399.3409	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	8.3200	10.6334	0.4400		0.0000		0.7700	29.9736 (74)
East	0.6000	19.6403	0.4400		0.0000		0.7700	3.9925 (76)
South	7.3000	46.7521	0.4400		0.0000		0.7700	115.6291 (78)
West	0.6000	19.6403	0.4400		0.0000		0.7700	3.9925 (80)

Solar gains	153.5876	262.2719	364.2834	466.4977	540.6926	545.9430	522.4493	464.9253	398.9336	290.9743	183.9924	131.4680	(83)
Total gains	565.7844	672.9325	760.4011	838.6242	887.2737	868.9362	830.7959	777.5152	724.4546	640.6344	561.3906	530.8090	(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	42.3799	42.4794	42.5773	43.0433	43.1317	43.5477	43.5477	43.6256	43.3865	43.1317	42.9534	42.7685	
alpha	3.8253	3.8320	3.8385	3.8696	3.8754	3.9032	3.9032	3.9084	3.8924	3.8754	3.8636	3.8512	
util living area	0.9965	0.9927	0.9844	0.9622	0.9071	0.7912	0.6438	0.6949	0.8812	0.9737	0.9935	0.9973	(86)
MIT	19.2181	19.4141	19.7263	20.1402	20.5317	20.8234	20.9428	20.9219	20.7002	20.1916	19.6288	19.1857	(87)
Th 2	19.8923	19.8946	19.8968	19.9074	19.9094	19.9187	19.9187	19.9204	19.9151	19.9094	19.9054	19.9012	(88)
util rest of house	0.9955	0.9907	0.9799	0.9500	0.8737	0.7112	0.5129	0.5693	0.8252	0.9630	0.9914	0.9965	(89)
MIT 2	18.2664	18.4632	18.7750	19.1897	19.5627	19.8201	19.8991	19.8907	19.7242	19.2461	18.6861	18.2407	(90)
Living area fraction										fLA = Living area / (4) =		0.1192	(91)
MIT	18.3798	18.5765	18.8883	19.3030	19.6781	19.9397	20.0234	20.0136	19.8405	19.3588	18.7985	18.3533	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3798	18.5765	18.8883	19.3030	19.6781	19.9397	20.0234	20.0136	19.8405	19.3588	18.7985	18.3533	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	562.1829	664.4527	740.8275	789.3452	767.4808	619.5452	437.7136	452.1165	594.4030	612.1515	554.8552	528.1502	(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	(96)
Heat loss rate W	1940.5631	1880.5734	1699.5259	1411.7051	1080.4334	716.2117	459.1864	483.8264	772.8318	1186.1517	1590.8336	1932.9820	(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	1025.5149	817.2331	713.2716	448.0991	232.8367	0.0000	0.0000	0.0000	0.0000	427.0562	745.9045	1045.1949	(98)
Space heating												5455.1110	(98)
Space heating per m2										(98) / (4) =		48.8722	(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	1260.8267	992.5657	1017.5709	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

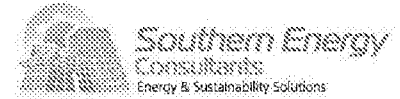


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7492	0.8283	0.7973	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	944.6682	822.1272	811.2854	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1127.2100	1080.2266	1020.1587	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	131.4302	192.0259	155.4017	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												478.8578 (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	32.8575	48.0065	38.8504	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												119.7144 (107)
Space cooling per m2												1.0725 (108)
Energy for space heating												48.8722 (99)
Energy for space cooling												1.0725 (108)
Total												49.9447 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.9 (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	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1472 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3972 (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) =	0.3376 (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	0.4304	0.4220	0.4136	0.3714	0.3629	0.3207	0.3207	0.3123	0.3376	0.3629	0.3798	0.3967 (22b)
Effective ac	0.5926	0.5890	0.5855	0.5690	0.5659	0.5514	0.5514	0.5488	0.5570	0.5659	0.5721	0.5787 (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)			16.8200	1.3258	22.2992		(27)
Heat Loss Floor 1			55.8100	0.1300	7.2553		(28a)
Brick Cavity	146.1000	21.1200	124.9800	0.1800	22.4964		(29a)
Main Plane	55.8100		55.8100	0.1300	7.2553		(30)
Total net area of external elements Aum(A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	64.0362		(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)							11.6310 (36)
Total fabric heat loss						(33) + (36) =	75.6672 (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	53.1549	52.8322	52.5160	51.0306	50.7527	49.4589	49.4589	49.2193	49.9572	50.7527	51.3149	51.9027 (38)
Heat transfer coeff	128.8221	128.4995	128.1832	126.6978	126.4199	125.1261	125.1261	124.8866	125.6245	126.4199	126.9821	127.5699 (39)
Average = Sum(39)m / 12 =												126.6965 (39)
HLP	1.1541	1.1512	1.1484	1.1351	1.1326	1.1210	1.1210	1.1189	1.1255	1.1326	1.1376	1.1429 (40)
HLP (average)												1.1351 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
Daily hot water use	111.4024	107.3514	103.3004	99.2494	95.1984	91.1474	91.1474	95.1984	99.2494	103.3004	107.3514	111.4024 (44)
Energy conte	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
Energy content (annual)										Total = Sum(45)m =		1593.4492 (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)

Regs Region: England

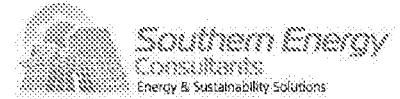
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FULL SAP CALCULATION PRINTOUT

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	35.1064	30.7043	31.6841	27.6229	26.5049	22.8717	21.1940	24.3204	24.6109	28.6816	31.3082	33.9987 (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	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	141.2104	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.7844	22.9014	18.6247	14.1001	10.5400	8.8983	9.6149	12.4979	16.7746	21.2992	24.8593	26.5010	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	273.8633	276.7051	269.5437	254.2981	235.0531	216.9656	204.8821	202.0402	209.2016	224.4472	243.6922	261.7797	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	37.1210	(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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	(71)
Water heating gains (Table 5)	47.1860	45.6909	42.5861	38.3652	35.6248	31.7662	28.4865	32.6887	34.1818	38.5505	43.4836	45.6971	(72)
Total internal gains	412.1968	410.6606	396.1177	372.1265	346.5811	322.9933	308.3466	312.5899	325.5210	349.6601	377.3982	399.3409	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	8.3200	10.6334	0.6300	0.7000	0.7700	27.0375	(74)
East	0.6000	19.6403	0.6300	0.7000	0.7700	3.6014	(76)
South	7.3000	46.7521	0.6300	0.7000	0.7700	104.3027	(78)
West	0.6000	19.6403	0.6300	0.7000	0.7700	3.6014	(80)

Solar gains	138.5430	236.5812	328.6002	420.8021	487.7293	492.4654	471.2730	419.3838	359.8562	262.4721	165.9695	118.5902	(83)
Total gains	550.7398	647.2417	724.7179	792.9286	834.3104	815.4586	779.6196	731.9736	685.3773	612.1321	543.3677	517.9311	(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	60.1713	60.3223	60.4712	61.1801	61.3146	61.9486	61.9486	62.0674	61.7029	61.3146	61.0432	60.7619	
alpha	5.0114	5.0215	5.0314	5.0787	5.0876	5.1299	5.1299	5.1378	5.1135	5.0876	5.0695	5.0508	
util living area	0.9992	0.9980	0.9946	0.9827	0.9421	0.8292	0.6667	0.7220	0.9173	0.9890	0.9982	0.9994	(86)
MIT	19.6539	19.8031	20.0424	20.3640	20.6711	20.8946	20.9739	20.9611	20.7988	20.4012	19.9690	19.6305	(87)
Th 2	19.9569	19.9592	19.9615	19.9723	19.9743	19.9837	19.9837	19.9855	19.9801	19.9743	19.9702	19.9660	(88)
util rest of house	0.9989	0.9973	0.9926	0.9752	0.9143	0.7480	0.5320	0.5917	0.8661	0.9829	0.9975	0.9992	(89)
MIT 2	18.7236	18.8744	19.1147	19.4412	19.7353	19.9298	19.9764	19.9731	19.8575	19.4819	19.0491	18.7075	(90)
Living area fraction									fLA = Living area / (4) =			0.1192	(91)
MIT	18.8345	18.9850	19.2252	19.5511	19.8468	20.0448	20.0953	20.0908	19.9696	19.5914	19.1587	18.8175	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8345	18.9850	19.2252	19.5511	19.8468	20.0448	20.0953	20.0908	19.9696	19.5914	19.1587	18.8175	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9963	0.9906	0.9712	0.9100	0.7536	0.5479	0.6067	0.8654	0.9797	0.9966	0.9989	(94)
Ext temp.	549.8951	644.8584	717.8696	770.0601	759.2109	614.5345	427.1593	444.0905	593.1339	599.7270	541.5290	517.3515	(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	1872.3641	1809.9202	1631.1571	1349.4737	1029.9136	681.2837	437.3492	460.9319	737.3685	1136.6924	1531.2405	1864.7518	(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	983.9169	782.9216	679.4859	417.1778	201.4028	0.0000	0.0000	0.0000	0.0000	399.5022	712.5923	1002.4658	(98)
Space heating												5179.4653	(98)
Space heating per m ²										(98) / (4) =		46.4027	(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	1176.1858	925.9335	949.1379	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7925	0.8747	0.8447	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	932.1764	809.8771	801.7820	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1064.7038	1020.4101	966.9283	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													

Regs Region: England

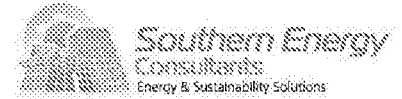
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

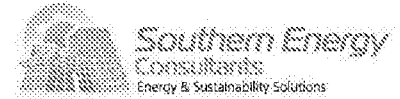


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	0.0000	0.0000	0.0000	0.0000	0.0000	95.4197	156.6366	122.8689	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												374.9252 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	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												
	0.0000	0.0000	0.0000	0.0000	0.0000	23.8549	39.1591	30.7172	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												93.7313 (107)
Space cooling per m2												0.8397 (108)
Energy for space heating												46.4027 (99)
Energy for space cooling												0.8397 (108)
Total												47.2424 (109)
Target Fabric Energy Efficiency (TFEE)												54.3 (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	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (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) = 0.1104 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3604 (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)	=	0.3063 (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	0.3216	0.3063	0.3063	0.2833	0.2833	0.2527	0.2604	0.2451	0.2527	0.2680	0.2680	0.2910 (22b)
Effective ac	0.5517	0.5469	0.5469	0.5401	0.5401	0.5319	0.5339	0.5300	0.5319	0.5359	0.5359	0.5423 (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)			16.8200	1.2357	20.7852		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			55.8100	0.1900	10.6039	75.0000	4185.7500 (28a)
Brick Cavity	146.1000	21.1200	124.9800	0.2500	31.2450	60.0000	7498.8000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Total net area of external elements Aum (A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2232		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21530.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.8880 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4484 (36)
Total fabric heat loss (33) + (36) = 84.6716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 49.4855	Feb 49.0541	Mar 49.0541	Apr 48.4466	May 48.4466	Jun 47.7102	Jul 47.8864	Aug 47.5393	Sep 47.7102	Oct 48.0679	Nov 48.0679	Dec 48.6439 (38)
Heat transfer coeff	134.1571	133.7257	133.7257	133.1182	133.1182	132.3818	132.5580	132.2109	132.3818	132.7395	132.7395	133.3155 (39)
Average = Sum(39)m / 12 =												133.0143 (39)
HLP	Jan 1.2019	Feb 1.1980	Mar 1.1980	Apr 1.1926	May 1.1926	Jun 1.1860	Jul 1.1876	Aug 1.1845	Sep 1.1860	Oct 1.1892	Nov 1.1892	Dec 1.1944 (40)
HLP (average)												1.1917 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
Daily hot water use	Jan 111.4024	Feb 107.3514	Mar 103.3004	Apr 99.2494	May 95.1984	Jun 91.1474	Jul 91.1474	Aug 95.1984	Sep 99.2494	Oct 103.3004	Nov 107.3514	Dec 111.4024 (44)
Energy conte	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
Energy content (annual)										Total = Sum(45)m =		1593.4492 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

**Southern Energy
Consultants**
Energy & Sustainability Solutions

Distribution loss	(46)m = 0.15 x (45)m											
	24.7810	21.6736	22.3652	19.4985	18.7093	16.1447	14.9605	17.1673	17.3724	20.2458	22.0999	23.9991 (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	14.1531	12.7721	14.1144	13.6224	14.0415	13.5482	13.9747	14.0180	13.5887	14.0805	13.6664	14.1405 (61)
Total heat required for water heating calculated for each month												
Solar input	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (62)
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (64)
								Total per year (kWh/year) = Sum(64)m =				1759.1698 (64)
RHI water heating demand												1759 (64)
Heat gains from water heating, kWh/month												
	58.4695	51.2362	53.1049	46.6274	44.9827	39.1745	36.6560	41.5588	41.9059	48.3984	52.4047	56.7331 (65)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
((66)m	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525 ((66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4609	57.2536	46.5618	35.2502	26.3500	22.2458	24.0373	31.2446	41.9365	53.2480	62.1483	66.2525 ((67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.7511	412.9927	402.3041	379.5494	350.8256	323.8293	305.7941	301.5525	312.2411	334.9959	363.7196	390.7159 ((68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695 ((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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683 ((71)
Water heating gains (Table 5)	78.5880	76.2443	71.3775	64.7603	60.4606	54.4091	49.2689	55.8586	58.2027	65.0516	72.7843	76.2541 ((72)
Total internal gains	666.0536	660.7442	634.4970	593.8135	551.8898	514.7377	493.3539	502.9094	526.6339	567.5491	612.9059	647.4761 ((73)

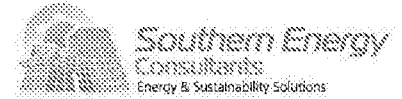
[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
North					8.3200	11.9814	0.4400	0.0000	0.7700			33.7735 (74)
East					0.6000	22.3313	0.4400	0.0000	0.7700			4.5395 (76)
South					7.3000	50.9848	0.4400	0.0000	0.7700			126.0977 (78)
West					0.6000	22.3313	0.4400	0.0000	0.7700			4.5395 (80)
Solar gains	168.9502	259.9057	358.1352	476.1979	540.9880	585.9597	554.1321	501.9034	426.3114	308.2451	207.3887	143.2102 (83)
Total gains	835.0038	920.6500	992.6321	1070.0114	1092.8778	1100.6974	1047.4860	1004.8128	952.9453	875.7942	820.2945	790.6863 (84)

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	44.5791	44.7229	44.7229	44.9270	44.9270	45.1769	45.1169	45.2353	45.1769	45.0552	45.0552	44.8605
alpha	3.9719	3.9815	3.9815	3.9951	3.9951	4.0118	4.0078	4.0157	4.0118	4.0037	4.0037	3.9907
util living area	0.9852	0.9772	0.9571	0.9051	0.7893	0.5675	0.3866	0.4134	0.7062	0.9129	0.9726	0.9877 (86)
MIT	19.6697	19.8217	20.1175	20.4821	20.7942	20.9621	20.9940	20.9922	20.9034	20.5437	20.0556	19.6387 (87)
Th 2	19.9185	19.9216	19.9216	19.9259	19.9259	19.9312	19.9299	19.9324	19.9312	19.9286	19.9286	19.9245 (88)
util rest of house	0.9813	0.9711	0.9452	0.8773	0.7268	0.4602	0.2561	0.2794	0.6096	0.8812	0.9640	0.9843 (89)
MIT 2	18.1809	18.4021	18.8260	19.3361	19.7357	19.9104	19.9287	19.9306	19.8635	19.4310	18.7469	18.1403 (90)
Living area fraction									fLa = Living area / (4) =			0.1192 (91)
MIT	18.3583	18.5713	18.9799	19.4727	19.8618	20.0358	20.0556	20.0571	19.9874	19.5636	18.9028	18.3189 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.2083	18.4213	18.8299	19.3227	19.7118	19.8858	19.9056	19.9071	19.8374	19.4136	18.7528	18.1689 (93)

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FULL SAP CALCULATION PRINTOUT

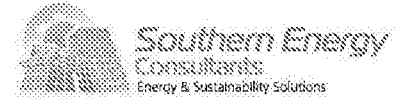
Calculation Type: New Build (As Designed)



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	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				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) =	0.1104 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3604 (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) =		0.3063 (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	0.3906	0.3829	0.3752	0.3370	0.3293	0.2910	0.2910	0.2833	0.3063	0.3293	0.3446	0.3599 (22b)
Effective ac	0.5763	0.5733	0.5704	0.5568	0.5542	0.5423	0.5423	0.5401	0.5469	0.5542	0.5594	0.5648 (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)			16.8200	1.2357	20.7852		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			55.8100	0.1900	10.6039	75.0000	4185.7500 (28a)
Brick Cavity	146.1000	21.1200	124.9800	0.2500	31.2450	60.0000	7498.8000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Total net area of external elements Aum (A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		75.2232		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21530.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.8880 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4484 (36)
Total fabric heat loss (33) + (36) = 84.6716 (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	51.6868	51.4212	51.1608	49.9378	49.7090	48.6439	48.6439	48.4466	49.0541	49.7090	50.1719	50.6558 (38)
Heat transfer coeff	136.3584	136.0928	135.8324	134.6094	134.3806	133.3155	133.3155	133.1182	133.7257	134.3806	134.8435	135.3274 (39)
Average = Sum(39)m / 12 =												134.6083 (39)
HLP	1.2216	1.2193	1.2169	1.2060	1.2039	1.1944	1.1944	1.1926	1.1980	1.2039	1.2081	1.2124 (40)
HLP (average)												1.2060 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.4024	107.3514	103.3004	99.2494	95.1984	91.1474	91.1474	95.1984	99.2494	103.3004	107.3514	111.4024 (44)
Energy conte	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
Energy content (annual)										Total = Sum(45)m =		1593.4492 (45)

Regs Region: England

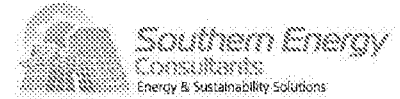
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	24.7810	21.6736	22.3652	19.4985	18.7093	16.1447	14.9605	17.1673	17.3724	20.2458	22.0999	23.9991 (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	14.1531	12.7721	14.1144	13.6224	14.0415	13.5482	13.9747	14.0180	13.5887	14.0805	13.6664	14.1405 (61)
Total heat required for water heating calculated for each month	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (64)
Heat gains from water heating, kWh/month	58.4695	51.2362	53.1049	46.6274	44.9827	39.1745	36.6560	41.5588	41.9059	48.3984	52.4047	56.7331 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1759.1698 (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	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4609	57.2536	46.5618	35.2502	26.3500	22.2458	24.0373	31.2446	41.9365	53.2480	62.1483	66.2525 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.7511	412.9927	402.3041	379.5494	350.8256	323.8293	305.7941	301.5525	312.2411	334.9959	363.7196	390.7159 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695 (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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683 (71)
Water heating gains (Table 5)	78.5880	76.2443	71.3775	64.7603	60.4606	54.4091	49.2689	55.8586	58.2027	65.0516	72.7843	76.2541 (72)
Total internal gains	666.0536	660.7442	634.4970	593.8135	551.8898	514.7377	493.3539	502.9094	526.6339	567.5491	612.9059	647.4761 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.3200	10.6334	0.4400	0.0000	0.7700	29.9736 (74)
East	0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (76)
South	7.3000	46.7521	0.4400	0.0000	0.7700	115.6291 (78)
West	0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (80)

Solar gains	153.5876	262.2719	364.2834	466.4977	540.6926	545.9430	522.4493	464.9253	398.9336	290.9743	183.9924	131.4680 (83)
Total gains	819.6412	923.0161	998.7804	1060.3112	1092.5824	1060.6807	1015.8032	967.8347	925.5675	858.5234	796.8983	778.9442 (84)

7. Mean internal temperature (heating season)

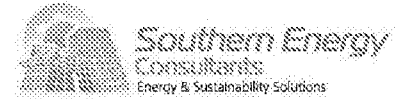
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.8594	43.9450	44.0293	44.4293	44.5049	44.8605	44.8605	44.9270	44.7229	44.5049	44.3522	44.1936
alpha	3.9240	3.9297	3.9353	3.9620	3.9670	3.9907	3.9907	3.9951	3.9815	3.9670	3.9568	3.9462
util living area	0.9883	0.9804	0.9647	0.9277	0.8485	0.7048	0.5483	0.5912	0.7980	0.9387	0.9802	0.9904 (86)
MIT	19.5171	19.6993	19.9821	20.3457	20.6726	20.8925	20.9699	20.9591	20.8130	20.3997	19.8918	19.4787 (87)
Th 2	19.9027	19.9046	19.9065	19.9152	19.9169	19.9245	19.9245	19.9259	19.9216	19.9169	19.9136	19.9101 (88)
util rest of house	0.9853	0.9753	0.9552	0.9069	0.8029	0.6177	0.4272	0.4707	0.7249	0.9169	0.9742	0.9879 (89)
MIT 2	17.9487	18.2135	18.6217	19.1411	19.5795	19.8431	19.9107	19.9054	19.7616	19.2261	18.5008	17.8979 (90)
Living area fraction	18.1356	18.3905	18.7838	19.2846	19.7098	19.9682	20.0369	20.0309	19.8869	19.3659	18.6666	18.0862 (92)
MIT	17.9856	18.2405	18.6338	19.1346	19.5598	19.8182	19.8869	19.8809	19.7369	19.2159	18.5166	17.9362 (93)
Temperature adjustment												-0.1500
adjusted MIT												17.9362 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	801.1090	890.0517	938.9074	941.2885	857.5967	645.0219	429.3665	450.3095	657.3211	770.9388	767.3729	764.1226 (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	1866.1425	1815.5476	1648.1616	1377.6769	1056.2015	695.6645	438.1954	463.3757	753.7930	1157.8095	1539.4519	1858.8900 (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	792.3849	621.9333	527.6851	314.1996	147.7620	0.0000	0.0000	0.0000	0.0000	287.8318	555.8969	814.5069 (98)
Space heating												4062.2006 (98)
Space heating per m2												36.3931 (99)

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													4488.6194 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	792.3849	621.9333	527.6851	314.1996	147.7620	0.0000	0.0000	0.0000	0.0000	287.8318	555.8969	814.5069	(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)	875.5634	687.2191	583.0775	347.1819	163.2729	0.0000	0.0000	0.0000	0.0000	318.0462	614.2507	900.0076	(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	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343	(64)
Efficiency of water heater (217)m	89.8918	89.8354	89.7231	89.4712	88.9214	87.3000	87.3000	87.3000	87.3000	89.3822	89.7611	89.9195	(216)
Fuel for water heating, kWh/month	199.5283	175.0566	181.9108	160.5128	156.0595	138.8084	130.2533	147.1558	148.2297	166.7588	179.3640	193.6559	(219)
Water heating fuel used												1977.2938	(219)
Annual totals kWh/year													
Space heating fuel - main system													4488.6194 (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)													455.3599 (232)
Total delivered energy for all uses													6996.2730 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4488.6194	3.4800	156.2040 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1977.2938	3.4800	68.8098 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	455.3599	13.1900	60.0620 (250)
Additional standing charges			120.0000 (251)
Total energy cost			414.9682 (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] =	1.1128 (257)
SAP value		84.4764
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	4488.6194	0.2160	969.5418 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1977.2938	0.2160	427.0955 (264)
Space and water heating			1396.6372 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.3599	0.5190	236.3318 (268)
Total kg/year			1671.8940 (272)
CO2 emissions per m2			14.9800 (273)
EI value			85.6957
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	$3.48 / 0.8884 = 3.917$, stars = 4
Water heating environmental impact	$0.216 / 0.8884 = 0.2431$, stars = 4

Regs Region: England

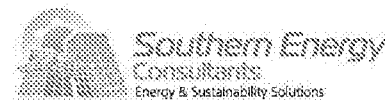
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				3 * 10 =	30.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)				30.0000 / (5) =	0.1104 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate				0.3604 (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) =		0.3063 (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	0.3216	0.3063	0.3063	0.2833	0.2833	0.2527	0.2604	0.2451	0.2527	0.2680	0.2680	0.2910 (22b)
Effective ac	0.5517	0.5469	0.5469	0.5401	0.5401	0.5319	0.5339	0.5300	0.5319	0.5359	0.5359	0.5423 (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)			16.8200	1.2357	20.7852		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			55.8100	0.1900	10.6039	75.0000	4185.7500 (28a)
Brick Cavity	146.1000	21.1200	124.9800	0.2500	31.2450	60.0000	7498.8000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Total net area of external elements Aum (A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	75.2232			(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21530.1600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.8880 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4484 (36)
Total fabric heat loss (33) + (36) = 84.6716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 49.4855	Feb 49.0541	Mar 49.0541	Apr 48.4466	May 48.4466	Jun 47.7102	Jul 47.8864	Aug 47.5393	Sep 47.7102	Oct 48.0679	Nov 48.0679	Dec 48.6439 (38)
Heat transfer coeff	134.1571	133.7257	133.7257	133.1182	133.1182	132.3818	132.5580	132.2109	132.3818	132.7395	132.7395	133.3155 (39)
Average = Sum(39)m / 12 =												133.0143 (39)
HLP	Jan 1.2019	Feb 1.1980	Mar 1.1980	Apr 1.1926	May 1.1926	Jun 1.1860	Jul 1.1876	Aug 1.1845	Sep 1.1860	Oct 1.1892	Nov 1.1892	Dec 1.1944 (40)
HLP (average)												1.1917 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
Daily hot water use	Jan 111.4024	Feb 107.3514	Mar 103.3004	Apr 99.2494	May 95.1984	Jun 91.1474	Jul 91.1474	Aug 95.1984	Sep 99.2494	Oct 103.3004	Nov 107.3514	Dec 111.4024 (44)
Energy conte	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
Energy content (annual)										Total = Sum(45)m =		1593.4492 (45)

Regs Region: England

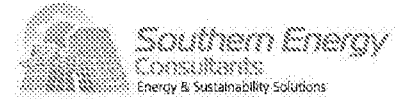
Elmhurst Energy Systems

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

Distribution loss (46)m = 0.15 x (45)m	24.7810	21.6736	22.3652	19.4985	18.7093	16.1447	14.9605	17.1673	17.3724	20.2458	22.0999	23.9991 (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	14.1531	12.7721	14.1144	13.6224	14.0415	13.5482	13.9747	14.0180	13.5887	14.0805	13.6664	14.1405 (61)
Total heat required for water heating calculated for each month	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (64)
Heat gains from water heating, kWh/month	58.4695	51.2362	53.1049	46.6274	44.9827	39.1745	36.6560	41.5588	41.9059	48.3984	52.4047	56.7331 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1759.1698 (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	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4609	57.2536	46.5618	35.2502	26.3500	22.2458	24.0373	31.2446	41.9365	53.2480	62.1483	66.2525	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.7511	412.9927	402.3041	379.5494	350.8256	323.8293	305.7941	301.5525	312.2411	334.9959	363.7196	390.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	(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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	(71)
Water heating gains (Table 5)	78.5880	76.2443	71.3775	64.7603	60.4606	54.4091	49.2689	55.8586	58.2027	65.0516	72.7843	76.2541	(72)
Total internal gains	666.0536	660.7442	634.4970	593.8135	551.8898	514.7377	493.3539	502.9094	526.6339	567.5491	612.9059	647.4761	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	8.3200	11.9814	0.4400	0.0000	0.7700	33.7735 (74)
East	0.6000	22.3313	0.4400	0.0000	0.7700	4.5395 (76)
South	7.3000	50.9848	0.4400	0.0000	0.7700	126.0977 (78)
West	0.6000	22.3313	0.4400	0.0000	0.7700	4.5395 (80)

Solar gains	168.9502	259.9057	358.1352	476.1979	540.9880	585.9597	554.1321	501.9034	426.3114	308.2451	207.3887	143.2102	(83)
Total gains	835.0038	920.6500	992.6321	1070.0114	1092.8778	1100.6974	1047.4860	1004.8128	952.9453	875.7942	820.2945	790.6863	(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	44.5791	44.7229	44.7229	44.9270	44.9270	45.1769	45.1169	45.2353	45.1769	45.0552	45.0552	44.8605	
alpha	3.9719	3.9815	3.9815	3.9951	3.9951	4.0118	4.0078	4.0157	4.0118	4.0037	4.0037	3.9907	
util living area	0.9852	0.9772	0.9571	0.9051	0.7893	0.5675	0.3866	0.4134	0.7062	0.9129	0.9726	0.9877	(86)
MIT	19.6697	19.8217	20.1175	20.4821	20.7942	20.9621	20.9940	20.9922	20.9034	20.5437	20.0556	19.6387	(87)
Th 2	19.9185	19.9216	19.9216	19.9259	19.9259	19.9312	19.9299	19.9324	19.9312	19.9286	19.9286	19.9245	(88)
util rest of house	0.9813	0.9711	0.9452	0.8773	0.7268	0.4602	0.2561	0.2794	0.6096	0.8812	0.9640	0.9843	(89)
MIT 2	18.1809	18.4021	18.8260	19.3361	19.7357	19.9104	19.9287	19.9306	19.8635	19.4310	18.7469	18.1403	(90)
Living area fraction	18.3583	18.5713	18.9799	19.4727	19.8618	20.0358	20.0556	20.0571	19.9874	19.5636	18.9028	18.3189	(91)
MIT	18.3583	18.5713	18.9799	19.4727	19.8618	20.0358	20.0556	20.0571	19.9874	19.5636	18.9028	18.3189	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2083	18.4213	18.8299	19.3227	19.7118	19.8858	19.9056	19.9071	19.8374	19.4136	18.7528	18.1689	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	811.6680	883.1047	922.0132	917.9297	778.5651	501.1571	265.0425	277.4122	571.8360	754.5335	779.7791	771.8682	(94)
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	1758.5744	1714.5361	1528.4692	1254.3264	893.4634	514.4036	265.8578	278.5800	613.9052	1037.1676	1427.3246	1742.2813	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	704.4983	558.7219	451.2032	242.2056	85.4843	0.0000	0.0000	0.0000	0.0000	210.2798	466.2328	721.9874	(98)
Space heating												3440.6133	(98)
Space heating per m2												30.8243	(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													3801.7826 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	704.4983	558.7219	451.2032	242.2056	85.4843	0.0000	0.0000	0.0000	0.0000	210.2798	466.2328	721.9874	(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)	778.4512	617.3722	498.5671	267.6305	94.4578	0.0000	0.0000	0.0000	0.0000	232.3533	515.1744	797.7761	(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	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343	(64)
Efficiency of water heater (217)m	89.8318	89.7772	89.6273	89.2818	88.4928	87.3000	87.3000	87.3000	87.3000	89.1446	89.6564	89.8599	(216)
Fuel for water heating, kWh/month	199.6617	175.1701	182.1052	160.8533	156.8155	138.8084	130.2533	147.1558	148.2297	167.2033	179.5734	193.7841	(219)
Water heating fuel used												1979.6135	(219)
Annual totals kWh/year													
Space heating fuel - main system												3801.7826	(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)												455.3599	(232)
Total delivered energy for all uses												6311.7560	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3801.7826	3.8700	147.1290 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1979.6135	3.8700	76.6110 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	455.3599	18.9000	86.0630 (250)
Additional standing charges			93.0000 (251)
Total energy cost			416.9780 (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	3801.7826	0.2160	821.1850 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1979.6135	0.2160	427.5965 (264)
Space and water heating			1248.7816 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	455.3599	0.5190	236.3318 (268)
Total kg/year			1524.0383 (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	3801.7826	1.2200	4638.1748 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1979.6135	1.2200	2415.1285 (264)
Space and water heating			7053.3033 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	455.3599	3.0700	1397.9548 (268)
Primary energy kWh/year			8681.5081 (272)
Primary energy kWh/m2/year			77.7774 (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	+ 1.0	-£ 30	-192 kg (12.6%)
U Solar photovoltaic panels	+ 8.5	-£ 345	-947 kg (71.1%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30	1.72 kg/m²	B 86 B 87
Solar photovoltaic panels	£345	8.48 kg/m²	A 94 A 95
Total Savings	£374	10.20 kg/m²	

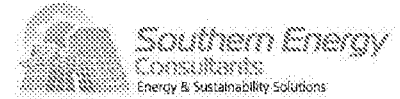
Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

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	£110	-£9
Mains gas	£317	£278	£39
Space heating	£254	£254	£0
Water heating	£77	£47	£30
Lighting	£86	£86	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£417	£43	£375
Total cost of uses	£417	£42	£375
Delivered energy	57 kWh/m²	32 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.5 tonnes	0.4 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	3 kg/m²	10 kg/m²
Primary energy	78 kWh/m²	18 kWh/m²	60 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	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (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)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1104 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3604 (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) =	0.3063 (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	0.3906	0.3829	0.3752	0.3370	0.3293	0.2910	0.2910	0.2833	0.3063	0.3293	0.3446	0.3599 (22b)
Effective ac	0.5763	0.5733	0.5704	0.5568	0.5542	0.5423	0.5423	0.5401	0.5469	0.5542	0.5594	0.5648 (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)			16.8200	1.2357	20.7852		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			55.8100	0.1900	10.6039	75.0000	4185.7500 (28a)
Brick Cavity	146.1000	21.1200	124.9800	0.2500	31.2450	60.0000	7498.8000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Total net area of external elements Aum (A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.2232		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21530.1600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.8880 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4484 (36)
 Total fabric heat loss (33) + (36) = 84.6716 (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	51.6868	51.4212	51.1608	49.9378	49.7090	48.6439	48.6439	48.4466	49.0541	49.7090	50.1719	50.6558 (38)
Heat transfer coeff	136.3584	136.0928	135.8324	134.6094	134.3806	133.3155	133.3155	133.1182	133.7257	134.3806	134.8435	135.3274 (39)
Average = Sum(39)m / 12 =												134.6083 (39)
HLP	1.2216	1.2193	1.2169	1.2060	1.2039	1.1944	1.1944	1.1926	1.1980	1.2039	1.2081	1.2124 (40)
HLP (average)												1.2060 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	111.4024	107.3514	103.3004	99.2494	95.1984	91.1474	91.1474	95.1984	99.2494	103.3004	107.3514	111.4024 (44)
Energy conte	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
Energy content (annual)										Total = Sum(45)m =		1593.4492 (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

Distribution loss (46)m = 0.15 x (45)m	24.7810	21.6736	22.3652	19.4985	18.7093	16.1447	14.9605	17.1673	17.3724	20.2458	22.0999	23.9991 (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	14.1531	12.7721	14.1144	13.6224	14.0415	13.5482	13.9747	14.0180	13.5887	14.0805	13.6664	14.1405 (61)
Total heat required for water heating calculated for each month	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1382 (H8)
Utilisation factor												0.5846 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.2749 (H14)
Volume ratio Veff/V												0.7406 (H15)
Solar storage volume factor												0.9399 (H16)
Solar input												-876.3143 (H17)
Solar input	-25.4114	-42.4043	-72.2193	-96.7881	-119.5736	-117.5599	-116.0063	-101.3553	-79.3815	-54.2082	-30.1415	-21.2650 (63)
Solar input (sum of months) = Sum(63)m =												-876.3143 (63)
Output from w/h	153.9483	114.8585	90.9966	46.8246	19.1968	3.6198	0.0000	27.1117	50.0230	94.8445	130.8576	152.8693 (64)
Total per year (kWh/year) = Sum(64)m =												885.1507 (64)
Heat gains from water heating, kWh/month	58.4695	51.2362	53.1049	46.6274	44.9827	39.1745	36.6560	41.5588	41.9059	48.3984	52.4047	56.7331 (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	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4609	57.2536	46.5618	35.2502	26.3500	22.2458	24.0373	31.2446	41.9365	53.2480	62.1483	66.2525	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.7511	412.9927	402.3041	379.5494	350.8256	323.8293	305.7941	301.5525	312.2411	334.9959	363.7196	390.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	(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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	(71)
Water heating gains (Table 5)	78.5880	76.2443	71.3775	64.7603	60.4606	54.4091	49.2689	55.8586	58.2027	65.0516	72.7843	76.2541	(72)
Total internal gains	666.0536	660.7442	634.4970	593.8135	551.8898	514.7377	493.3539	502.9094	526.6339	567.5491	612.9059	647.4761	(73)

6. Solar gains

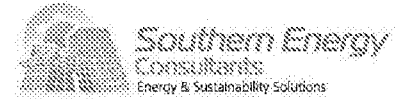
[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				8.3200	10.6334		0.4400		0.0000		0.7700		29.9736 (74)
East				0.6000	19.6403		0.4400		0.0000		0.7700		3.9925 (76)
South				7.3000	46.7521		0.4400		0.0000		0.7700		115.6291 (78)
West				0.6000	19.6403		0.4400		0.0000		0.7700		3.9925 (80)
Solar gains	153.5876	262.2719	364.2834	466.4977	540.6926	545.9430	522.4493	464.9253	398.9336	290.9743	183.9924		131.4680 (83)
Total gains	819.6412	923.0161	998.7804	1060.3112	1092.5824	1060.6807	1015.8032	967.8347	925.5675	858.5234	796.8983		778.9442 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	43.8594	43.9450	44.0293	44.4293	44.5049	44.8605	44.8605	44.9270	44.7229	44.5049	44.3522	44.1936	
alpha	3.9240	3.9297	3.9353	3.9620	3.9670	3.9907	3.9907	3.9951	3.9815	3.9670	3.9568	3.9462	
util living area	0.9883	0.9804	0.9647	0.9277	0.8485	0.7048	0.5483	0.5912	0.7980	0.9387	0.9802	0.9904	(86)
MIT	19.5171	19.6993	19.9821	20.3457	20.6726	20.8925	20.9699	20.9591	20.8130	20.3997	19.8918	19.4787	(87)
Th 2	19.9027	19.9046	19.9065	19.9152	19.9169	19.9245	19.9245	19.9259	19.9216	19.9169	19.9136	19.9101	(88)
util rest of house	0.9853	0.9753	0.9552	0.9069	0.8029	0.6177	0.4272	0.4707	0.7249	0.9169	0.9742	0.9879	(89)
MIT 2	17.9487	18.2135	18.6217	19.1411	19.5795	19.8431	19.9107	19.9054	19.7616	19.2261	18.5008	17.8979	(90)
Living area fraction									fLA = Living area / (4) =			0.1192	(91)
MIT	18.1356	18.3905	18.7838	19.2846	19.7098	19.9682	20.0369	20.0309	19.8869	19.3659	18.6666	18.0862	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9856	18.2405	18.6338	19.1346	19.5598	19.8182	19.8869	19.8809	19.7369	19.2159	18.5166	17.9362	(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	0.9774	0.9643	0.9401	0.8877	0.7849	0.6081	0.4227	0.4653	0.7102	0.8980	0.9629	0.9810	(94)
Useful gains	801.1090	890.0517	938.9074	941.2885	857.5967	645.0219	429.3665	450.3095	657.3211	770.9388	767.3729	764.1226	(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	1866.1425	1815.5476	1648.1616	1377.6769	1056.2015	695.6645	438.1954	463.3757	753.7930	1157.8095	1539.4519	1858.8900	(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	792.3849	621.9333	527.6851	314.1996	147.7620	0.0000	0.0000	0.0000	0.0000	287.8318	555.8969	814.5069	(98)
Space heating												4062.2006	(98)
Space heating per m2											(98) / (4) =	36.3931	(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													4488.6194 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	792.3849	621.9333	527.6851	314.1996	147.7620	0.0000	0.0000	0.0000	0.0000	287.8318	555.8969	814.5069	(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)	875.5634	687.2191	583.0775	347.1819	163.2729	0.0000	0.0000	0.0000	0.0000	318.0462	614.2507	900.0076	(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	153.9483	114.8585	90.9966	46.8246	19.1968	3.6198	0.0000	27.1117	50.0230	94.8445	130.8576	152.8693	(64)
Efficiency of water heater	89.9635	89.9858	90.0147	90.0718	90.1202	87.3000	87.3000	87.3000	87.3000	89.6852	89.8723	89.9788	(216)
(217)m	89.9635	89.9858	90.0147	90.0718	90.1202	87.3000	87.3000	87.3000	87.3000	89.6852	89.8723	89.9788	(217)
Fuel for water heating, kWh/month	171.1230	127.6407	101.0908	51.9859	21.3013	4.1464	0.0000	31.0558	57.3001	105.7526	145.6039	169.8948	(219)
Water heating fuel used												986.8954	(219)
Annual totals kWh/year													
Space heating fuel - main system												4488.6194	(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)													455.3599 (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												4328.6353	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4488.6194	3.4800	156.2040	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	986.8954	3.4800	34.3440	(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	455.3599	13.1900	60.0620	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			159.2745	(255)

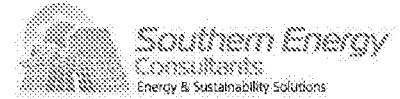
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4271 (257)
SAP value		94.0417
SAP rating (Section 12)		94 (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	4488.6194	0.2160	969.5418 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	986.8954	0.2160	213.1694 (264)
Space and water heating			1182.7112 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	455.3599	0.5190	236.3318 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			587.4807 (272)
CO2 emissions per m2			5.2600 (273)
EI value			94.9737
EI rating			95 (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	55.8100 (1b)	x 2.3500 (2b)	= 131.1535 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	111.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 271.7947 (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) = 0.1104 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3604 (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) = 0.3063 (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	0.3216	0.3063	0.3063	0.2833	0.2833	0.2527	0.2604	0.2451	0.2527	0.2680	0.2680	0.2910 (22b)
Effective ac	0.5517	0.5469	0.5469	0.5401	0.5401	0.5319	0.5339	0.5300	0.5319	0.5359	0.5359	0.5423 (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)			16.8200	1.2357	20.7852		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			55.8100	0.1900	10.6039	75.0000	4185.7500 (28a)
Brick Cavity	146.1000	21.1200	124.9800	0.2500	31.2450	60.0000	7498.8000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Total net area of external elements Aum (A, m ²)			257.7200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	75.2232		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 21530.1600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.8880 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.4484 (36)
 Total fabric heat loss (33) + (36) = 84.6716 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	49.4855	49.0541	49.0541	48.4466	48.4466	47.7102	47.8864	47.5393	47.7102	48.0679	48.0679	48.6439 (38)
Average = Sum(39)m / 12 =	134.1571	133.7257	133.7257	133.1182	133.1182	132.3818	132.5580	132.2109	132.3818	132.7395	132.7395	133.3155 (39)
												133.0143 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2019	1.1980	1.1980	1.1926	1.1926	1.1860	1.1876	1.1845	1.1860	1.1892	1.1892	1.1944 (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												2.8242 (42)
Average daily hot water use (litres/day)												101.2749 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	111.4024	107.3514	103.3004	99.2494	95.1984	91.1474	91.1474	95.1984	99.2494	103.3004	107.3514	111.4024 (44)
Energy content (annual)	165.2066	144.4907	149.1015	129.9903	124.7288	107.6315	99.7364	114.4489	115.8158	134.9722	147.3327	159.9938 (45)
										Total = Sum(45)m =		1593.4492 (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

Distribution loss (46)m = 0.15 x (45)m	24.7810	21.6736	22.3652	19.4985	18.7093	16.1447	14.9605	17.1673	17.3724	20.2458	22.0999	23.9991 (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	14.1531	12.7721	14.1144	13.6224	14.0415	13.5482	13.9747	14.0180	13.5887	14.0805	13.6664	14.1405 (61)
Total heat required for water heating calculated for each month	179.3597	157.2628	163.2159	143.6127	138.7703	121.1797	113.7111	128.4670	129.4045	149.0527	160.9991	174.1343 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2020 (H8)
Utilisation factor												0.5648 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												101.2749 (H14)
Volume ratio Veff/V												0.7406 (H15)
Solar storage volume factor												0.9399 (H16)
Solar input	-27.5189	-41.3608	-69.6568	-96.2871	-115.9620	-122.0450	-119.1145	-106.3699	-83.0221	-56.4784	-33.4499	-894.0650 (H17)
Solar input (sum of months) = Sum(63)m =												-894.0650 (63)
Output from w/h	151.8408	115.9020	93.5591	47.3257	22.8083	0.0000	0.0000	22.0971	46.3824	92.5743	127.5492	151.3348 (64)
Total per year (kWh/year) = Sum(64)m =												871.3735 (64)
Heat gains from water heating, kWh/month	58.4695	51.2362	53.1049	46.6274	44.9827	39.1745	36.6560	41.5588	41.9059	48.3984	52.4047	56.7331 (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	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	169.4525	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.4609	57.2536	46.5618	35.2502	26.3500	22.2458	24.0373	31.2446	41.9365	53.2480	62.1483	66.2525	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	408.7511	412.9927	402.3041	379.5494	350.8256	323.8293	305.7941	301.5525	312.2411	334.9959	363.7196	390.7159	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	54.7695	(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)	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	-112.9683	(71)
Water heating gains (Table 5)	78.5880	76.2443	71.3775	64.7603	60.4606	54.4091	49.2689	55.8586	58.2027	65.0516	72.7843	76.2541	(72)
Total internal gains	666.0536	660.7442	634.4970	593.8135	551.8898	514.7377	493.3539	502.9094	526.6339	567.5491	612.9059	647.4761	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				8.3200		11.9814	0.4400		0.0000		0.7700		33.7735 (74)
East				0.6000		22.3313	0.4400		0.0000		0.7700		4.5395 (76)
South				7.3000		50.9848	0.4400		0.0000		0.7700		126.0977 (78)
West				0.6000		22.3313	0.4400		0.0000		0.7700		4.5395 (80)
Solar gains	168.9502	259.9057	358.1352	476.1979	540.9880	585.9597	554.1321	501.9034	426.3114	308.2451	207.3887		143.2102 (83)
Total gains	835.0038	920.6500	992.6321	1070.0114	1092.8778	1100.6974	1047.4860	1004.8128	952.9453	875.7942	820.2945		790.6863 (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	44.5791	44.7229	44.7229	44.9270	44.9270	45.1769	45.1169	45.2353	45.1769	45.0552	45.0552	44.8605	
alpha	3.9719	3.9815	3.9815	3.9951	3.9951	4.0118	4.0078	4.0157	4.0118	4.0037	4.0037	3.9907	
util living area	0.9852	0.9772	0.9571	0.9051	0.7893	0.5675	0.3866	0.4134	0.7062	0.9129	0.9726	0.9877	(86)
MIT	19.6697	19.8217	20.1175	20.4821	20.7942	20.9621	20.9940	20.9922	20.9034	20.5437	20.0556	19.6387	(87)
Th 2	19.9185	19.9216	19.9216	19.9259	19.9259	19.9312	19.9299	19.9324	19.9312	19.9286	19.9286	19.9245	(88)
util rest of house	0.9813	0.9711	0.9452	0.8773	0.7268	0.4602	0.2561	0.2794	0.6096	0.8812	0.9640	0.9843	(89)
MIT 2	18.1809	18.4021	18.8260	19.3361	19.7357	19.9104	19.9287	19.9306	19.8635	19.4310	18.7469	18.1403	(90)
Living area fraction									fLA = Living area / (4) =			0.1192	(91)
MIT	18.3583	18.5713	18.9799	19.4727	19.8618	20.0358	20.0556	20.0571	19.9874	19.5636	18.9028	18.3189	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.2083	18.4213	18.8299	19.3227	19.7118	19.8858	19.9056	19.9071	19.8374	19.4136	18.7528	18.1689	(93)

Southern Energy Consultants
Energy & Sustainability Solutions

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9721	0.9592	0.9289	0.8579	0.7124	0.4553	0.2530	0.2761	0.6001	0.8615	0.9506	0.9762 (94)
Useful gains	811.6680	883.1047	922.0132	917.9297	778.5651	501.1571	265.0425	277.4122	571.8360	754.5335	779.7791	771.8682 (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	1758.5744	1714.5361	1528.4692	1254.3264	893.4634	514.4036	265.8578	278.5800	613.9052	1037.1676	1427.3246	1742.2813 (97)
Month fractl	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	704.4983	558.7219	451.2032	242.2056	85.4843	0.0000	0.0000	0.0000	0.0000	210.2798	466.2328	721.9874 (98)
Space heating												3440.6133 (98)
Space heating per m2												30.8243 (99)
										(98) / (4) =		

8c. Space cooling requirement

Not applicable

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

[illegible]

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3801.7826	3.8700	147.1290 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	971.9909	3.8700	37.6160 (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	455.3599	18.9000	86.0630 (250)
Additional standing charges			93.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	18.9000	-344.7662 (252)
Total energy cost			42.6669 (255)

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

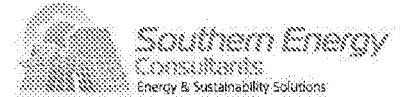
	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	3801.7826	0.2160	821.1850 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	971.9909	0.2160	209.9500 (264)
Space and water heating			1031.1351 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	455.3599	0.5190	236.3318 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)



ICT COUNCIL A/38/21/DOC

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 385.6030 (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	3801.7826	1.2200	4638.1748 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	971.9909	1.2200	1185.8290 (264)
Space and water heating			5824.0037 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	455.3599	3.0700	1397.9548 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2005.5384 (272)
Primary energy kWh/m2/year			17.9676 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
Overshading	Average or unknown
Thermal mass parameter	192.9 (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	358.77 (P1)
Transmission heat loss coefficient	84.67 (37)
Summer heat loss coefficient	443.44 (P2)

Overhangs	Ratio	Z_overhangs	Overhang type
Orientation			
North	0.000	1.000	None
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				
North	1.000	0.90	1.000	0.900 (P8)
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
North	8.3200	81.1852	0.4400	0.0000	0.9000	267.4824
East	0.6000	117.5071	0.4400	0.0000	0.9000	27.9197
South	7.3000	112.2060	0.4400	0.0000	0.9000	324.3651
West	0.6000	117.5071	0.4400	0.0000	0.9000	27.9197

total: 647.6869

	Jun	Jul	Aug	
Solar gains	685	648	587	(P4)
Internal gains	512	490	500	
Total summer gains	1197	1138	1087	(P5)
Summer gain/loss ratio	2.70	2.57	2.45	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 192.9)	0.65	0.65	0.65	
Threshold temperature	19.35	21.12	20.90	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			