

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG002c			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Cl Ea Ga		
Property	Coniston, Plot 22				
SAP Rating	85 B	DER	16.28	TET	17.08
Environmental	36 B	% DER<TER	4.70		
CO ₂ Emissions (t/year)	1.50	DPEE	49.15	TPEE	54.28
General Requirements Compliance	Pass	% DPEE<TPEE	9.45		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon 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) 17.08 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.28 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (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:

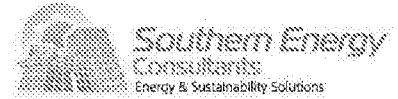
Overshading: Average
Windows facing North: 7.30 m², No overhang
Windows facing East: 0.60 m², No overhang
Windows facing South: 8.32 m², No overhang
Windows facing West: 3.67 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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												
Effective ac	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)
	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)			19.8900	1.2357	24.5789		(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)
Clad Cavity	146.1000	24.1900	121.9100	0.2400	29.2584	60.0000	7314.6000 (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) =	77.0303		(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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 21345.9600 (34)												
191.2378 (35)												
10.2115 (36)												
(33) + (36) = 87.2418 (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	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)
Average = Sum(39)m / 12 =	138.9286	138.6629	138.4026	137.1796	136.9508	135.8857	135.8857	135.6884	136.2959	136.9508	137.4137	137.8976 (39)
												137.1785 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2447	1.2423	1.2399	1.2290	1.2269	1.2174	1.2174	1.2156	1.2211	1.2269	1.2311	1.2354 (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

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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	24.9772	22.1845	18.0417	13.6587	10.2101	8.6198	9.3139	12.1066	16.2495	20.6325	24.0811	25.6714 (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	445.7916	443.4971	427.3260	401.0802	374.0869	348.3576	331.8280	338.3685	352.0169	378.4944	408.9207	432.0683 (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					7.3000	10.6334	0.4400	0.0000	0.7700		26.2989 (74)	
East					0.6000	19.6403	0.4400	0.0000	0.7700		3.9925 (76)	
South					8.3200	46.7521	0.4400	0.0000	0.7700		131.7855 (78)	
West					3.6700	19.6403	0.4400	0.0000	0.7700		24.4206 (80)	
Solar gains	186.4975	321.6713	451.8673	581.4069	672.1988	676.9194	648.6089	579.1741	496.3371	358.5727	224.0816	159.1644 (83)
Total gains	632.2891	765.1684	879.1934	982.4870	1046.2858	1025.2769	980.4369	917.5426	848.3539	737.0671	633.0024	591.2327 (84)

7. Mean internal temperature (heating season)

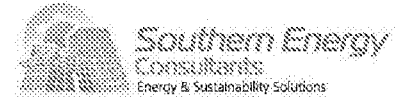
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	42.6797	42.7615	42.8419	43.2239	43.2961	43.6355	43.6355	43.6989	43.5041	43.2961	43.1502	42.9988
alpha	3.8453	3.8508	3.8561	3.8816	3.8864	3.9090	3.9090	3.9133	3.9003	3.8864	3.8767	3.8666
util living area	0.9951	0.9893	0.9763	0.9422	0.8654	0.7262	0.5721	0.6236	0.8348	0.9612	0.9907	0.9962 (86)
MIT	19.2888	19.5060	19.8365	20.2545	20.6259	20.8726	20.9623	20.9470	20.7637	20.2727	19.6978	19.2481 (87)
Th 2	19.8844	19.8863	19.8882	19.8969	19.8985	19.9061	19.9061	19.9075	19.9032	19.8985	19.8952	19.8918 (88)
util rest of house	0.9938	0.9864	0.9695	0.9247	0.8224	0.6392	0.4462	0.4988	0.7671	0.9460	0.9877	0.9952 (89)
MIT 2	17.6066	17.9239	18.4036	19.0044	19.5082	19.8081	19.8886	19.8803	19.6944	19.0411	18.2109	17.5519 (90)
Living area fraction	17.8071	18.1125	18.5744	19.1534	19.6414	19.9350	20.0165	20.0074	19.8218	19.1879	18.3880	17.7540 (92)
MIT	17.8071	18.1125	18.5744	19.1534	19.6414	19.9350	20.0165	20.0074	19.8218	19.1879	18.3880	17.7540 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6571	17.9625	18.4244	19.0034	19.4914	19.7850	19.8665	19.8574	19.6718	19.0379	18.2380	17.6040 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	625.6161	748.9136	841.1815	890.0193	840.2570	644.1248	432.6734	451.8792	636.0004	684.7576	620.7263	586.3127 (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	1855.6771	1811.2786	1650.3624	1385.9801	1067.0363	704.5631	443.8699	469.1237	759.4150	1155.5757	1530.5189	1848.3753 (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	915.1654	713.9093	602.0306	357.0918	168.7238	0.0000	0.0000	0.0000	0.0000	350.2887	655.0507	938.9746 (98)
Space heating												4701.2347 (98)
Space heating per m2												42.1182 (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													5194.7345	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	915.1654	713.9093	602.0306	357.0918	168.7238	0.0000	0.0000	0.0000	0.0000	350.2887	655.0507	938.9746	(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)	1011.2325	788.8500	665.2272	394.5766	186.4351	0.0000	0.0000	0.0000	0.0000	387.0593	723.8129	1037.5409	(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	89.9596	89.9051	89.7980	89.5584	89.0273	87.3000	87.3000	87.3000	87.3000	89.5205	89.8502	89.9840	(217)	
Fuel for water heating, kWh/month	199.3779	174.9209	181.7590	160.3565	155.8739	138.8084	130.2533	147.1558	148.2297	166.5012	179.1861	193.5170	(219)	
Water heating fuel used												1975.9395	(219)	
Annual totals kWh/year														
Space heating fuel - main system													5194.7345	(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)													441.1055	(232)
Total delivered energy for all uses													7686.7796	(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	5194.7345	0.2160	1122.0627 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1975.9395	0.2160	426.8029 (264)
Space and water heating			1548.8656 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.1055	0.5190	228.9338 (268)
Total CO2, kg/year			1816.7244 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.2800 (273)

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

DER			16.2800	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			32.4925	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			32.4925	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)			19.8900	1.3258	26.3693		(27)
Heat Loss Floor 1			55.8100	0.1300	7.2553		(28a)
Clad Cavity	146.1000	24.1900	121.9100	0.1800	21.9438		(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) =	67.5537		(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)							12.1280 (36)
Total fabric heat loss						(33) + (36) =	79.6817 (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	132.8366	132.5140	132.1977	130.7123	130.4344	129.1406	129.1406	128.9010	129.6390	130.4344	130.9966	131.5844 (39)
Average = Sum(39)m / 12 =												130.7110 (39)
HLP	1.1901	1.1872	1.1844	1.1710	1.1686	1.1570	1.1570	1.1548	1.1614	1.1686	1.1736	1.1789 (40)
HLP (average)												1.1710 (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	24.9772	22.1845	18.0417	13.6587	10.2101	8.6198	9.3139	12.1066	16.2495	20.6325	24.0811	25.6714 (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	458.1591	455.8689	439.7066	413.3449	385.6698	359.2607	342.7396	349.9593	364.2933	390.8863	421.2987	444.4401 (73)

6. Solar gains

[Jan]												Gains
					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		W	
North					7.3000	10.6334	0.6300	0.7000	0.7700		23.7228 (74)	
East					0.6000	19.6403	0.6300	0.7000	0.7700		3.6014 (76)	
South					8.3200	46.7521	0.6300	0.7000	0.7700		118.8765 (78)	
West					3.6700	19.6403	0.6300	0.7000	0.7700		22.0285 (80)	
Solar gains	168.2292	290.1621	407.6049	524.4554	606.3539	610.6120	585.0747	522.4413	447.7186	323.4489	202.1318	143.5735 (83)
Total gains	626.3884	746.0310	847.3114	937.8003	992.0237	969.8728	927.8143	872.4006	812.0119	714.3352	623.4306	588.0136 (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	58.3528	58.4949	58.6348	59.3011	59.4275	60.0229	60.0229	60.1344	59.7921	59.4275	59.1724	58.9081
alpha	4.8902	4.8997	4.9090	4.9534	4.9618	5.0015	5.0015	5.0090	4.9861	4.9618	4.9448	4.9272
util living area	0.9985	0.9962	0.9898	0.9680	0.9039	0.7605	0.5909	0.6448	0.8705	0.9799	0.9967	0.9989 (86)
MIT	19.6695	19.8381	20.0984	20.4352	20.7347	20.9253	20.9832	20.9744	20.8425	20.4495	19.9951	19.6414 (87)
Th 2	19.9279	19.9303	19.9325	19.9432	19.9452	19.9546	19.9546	19.9563	19.9510	19.9452	19.9412	19.9369 (88)
util rest of house	0.9980	0.9949	0.9860	0.9552	0.8640	0.6696	0.4613	0.5153	0.8033	0.9695	0.9953	0.9986 (89)
MIT 2	18.1530	18.4008	18.7810	19.2708	19.6771	19.9028	19.9482	19.9454	19.8204	19.2988	18.6385	18.1182 (90)
Living area fraction	18.3337	18.5721	18.9379	19.4096	19.8031	20.0246	20.0715	20.0680	19.9422	19.4359	18.8001	0.1192 (91)
MIT	18.3337	18.5721	18.9379	19.4096	19.8031	20.0246	20.0715	20.0680	19.9422	19.4359	18.8001	18.2997 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3337	18.5721	18.9379	19.4096	19.8031	20.0246	20.0715	20.0680	19.9422	19.4359	18.8001	18.2997 (93)

8. Space heating requirement

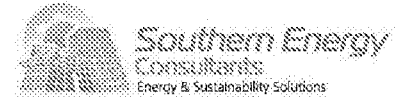
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9968	0.9923	0.9809	0.9466	0.8575	0.6764	0.4765	0.5301	0.8027	0.9624	0.9930	0.9976 (94)
Useful gains	624.3770	740.3216	831.1385	887.7259	850.6527	655.9885	442.1417	462.4812	651.7671	687.4841	619.0822	586.6156 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1864.1873	1811.7412	1644.2677	1373.7324	1056.9199	700.5402	448.3162	472.8124	757.3724	1152.5014	1532.6786	1855.3038 (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	922.4188	719.9939	604.9681	349.9247	153.4628	0.0000	0.0000	0.0000	0.0000	345.9729	657.7894	943.9040 (98)
Space heating												4698.4347 (98)
Space heating per m2												(98) / (4) = 42.0931 (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													5030.4440 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.4188	719.9939	604.9681	349.9247	153.4628	0.0000	0.0000	0.0000	0.0000	345.9729	657.7894	943.9040	(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)	987.6005	770.8715	647.7174	374.6517	164.3071	0.0000	0.0000	0.0000	0.0000	370.4206	704.2713	1010.6039	(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	88.2916	88.0818	87.6600	86.7100	84.7476	80.3000	80.3000	80.3000	80.3000	86.5928	87.6567	88.3697	(217)
Fuel for water heating, kWh/month	244.8312	216.2967	228.2233	206.3606	204.4197	190.0136	182.0475	202.9403	205.1815	214.7189	223.8277	238.7161	(219)
Water heating fuel used												2557.5771	(219)
Annual totals kWh/year													
Space heating fuel - main system												5030.4440	(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)												441.1055	(232)
Total delivered energy for all uses												8104.1267	(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	5030.4440	0.2160	1086.5759 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2557.5771	0.2160	552.4367 (264)
Space and water heating			1639.0126 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.1055	0.5190	228.9338 (268)
Total CO2, kg/m2/year			1906.8713 (272)
Emissions per m2 for space and water heating			14.6839 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0510 (272b)
Emissions per m2 for pumps and fans			0.3487 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6839 * 1.00) + 2.0510 + 0.3487, rounded to 2 d.p.			17.0800 (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)
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
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			19.8900	1.2357	24.5789		(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)
Clad Cavity	146.1000	24.1900	121.9100	0.2400	29.2584	60.0000	7314.6000 (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) =	77.0303		(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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

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 =	140.3967	140.0740	139.7578	138.2724	137.9944	136.7007	136.7007	136.4611	137.1990	137.9944	138.5567	139.1444 (39)
												138.2710 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2578	1.2549	1.2521	1.2388	1.2363	1.2247	1.2247	1.2226	1.2292	1.2363	1.2413	1.2466 (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	24.9772	22.1845	19.0417	13.6587	10.2101	8.6198	9.3139	12.1066	16.2495	20.6325	24.0811	25.6714	(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	411.3896	409.9437	395.5347	371.6851	346.2511	322.7147	308.0457	312.1987	324.9959	348.9933	376.6200	398.5114	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
North	7.3000	10.6334	0.4400		0.0000	0.7700	26.2989	(74)
East	0.6000	19.6403	0.4400		0.0000	0.7700	3.9925	(76)
South	8.3200	46.7521	0.4400		0.0000	0.7700	131.7855	(78)
West	3.6700	19.6403	0.4400		0.0000	0.7700	24.4206	(80)

Solar gains	186.4975	321.6713	451.8673	581.4069	672.1988	676.9194	648.6089	579.1741	496.3371	358.5727	224.0816	159.1644	(83)
Total gains	597.8871	731.6150	847.4020	953.0920	1018.4500	999.6341	956.6546	891.3727	821.3330	707.5660	600.7016	557.6758	(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	41.2396	41.3346	41.4282	41.8732	41.9575	42.3546	42.3546	42.4290	42.2008	41.9575	41.7873	41.6108	
alpha	3.7493	3.7556	3.7619	3.7915	3.7972	3.8236	3.8236	3.8286	3.8134	3.7972	3.7858	3.7741	
util living area	0.9956	0.9901	0.9778	0.9454	0.8720	0.7369	0.5844	0.6376	0.8444	0.9642	0.9916	0.9966	(86)
MIT	19.2041	19.4275	19.7686	20.2040	20.5922	20.8570	20.9562	20.9385	20.7385	20.2234	19.6293	19.1662	(87)
Th 2	19.8740	19.8763	19.8786	19.8891	19.8911	19.9003	19.9003	19.9020	19.8967	19.8911	19.8871	19.8829	(88)
util rest of house	0.9944	0.9875	0.9715	0.9288	0.8307	0.6509	0.4571	0.5121	0.7793	0.9502	0.9889	0.9957	(89)
MIT 2	18.2397	18.4635	18.8028	19.2352	19.5978	19.8239	19.8860	19.8798	19.7364	19.2621	18.6736	18.2085	(90)
Living area fraction									fLA = Living area / (4) =			0.1192	(91)
MIT	18.3546	18.5783	18.9179	19.3506	19.7163	19.9470	20.0135	20.0060	19.8558	19.3766	18.7875	18.3226	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3546	18.5783	18.9179	19.3506	19.7163	19.9470	20.0135	20.0060	19.8558	19.3766	18.7875	18.3226	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	593.1324	719.3237	817.1706	875.5697	838.1112	654.7569	450.7753	468.0442	637.6843	666.2075	591.7764	554.2237	(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	1973.2158	1915.9792	1735.5005	1445.0343	1106.2008	730.9352	466.6284	492.0746	789.6849	1211.1259	1619.3814	1965.0871	(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	1026.7821	804.1525	683.2375	410.0145	199.4586	0.0000	0.0000	0.0000	0.0000	405.4193	739.8756	1049.6824	(98)
Space heating												5318.6224	(98)
Space heating per m2										(98) / (4) =		47.6494	(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	1284.9865	1011.5851	1037.1044	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

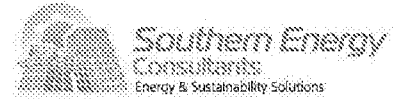


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7910	0.8615	0.8326	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1016.4507	871.4705	863.4711	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1279.6030	1226.9334	1152.7181	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	189.4696	264.4644	215.1998	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction												669.1339 (104)
Intermittency factor (Table 10b)												1.0000 (105)
									FC = cooled area / (4) =			
0.0000	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	0.0000	47.3674	66.1161	53.8000	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												167.2835 (107)
Space cooling per m2												1.4987 (108)
Energy for space heating												47.6494 (99)
Energy for space cooling												1.4987 (108)
Total												49.1481 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.1 (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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1472 (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)			19.8900	1.3258	26.3693		(27)
Heat Loss Floor 1			55.8100	0.1300	7.2553		(28a)
Clad Cavity	146.1000	24.1900	121.9100	0.1800	21.9438		(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) =	67.5537		(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)							12.1280 (36)
Total fabric heat loss						(33) + (36) =	79.6817 (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	132.8366	132.5140	132.1977	130.7123	130.4344	129.1406	129.1406	128.9010	129.6390	130.4344	130.9966	131.5844 (39)
Average = Sum(39)m / 12 =												130.7110 (39)
HLP	1.1901	1.1872	1.1844	1.1710	1.1686	1.1570	1.1570	1.1548	1.1614	1.1686	1.1736	1.1789 (40)
HLP (average)												1.1710 (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

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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	24.9772	22.1845	18.0417	13.6587	10.2101	8.6198	9.3139	12.1066	16.2495	20.6325	24.0811	25.6714	(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	411.3896	409.9437	395.5347	371.6851	346.2511	322.7147	308.0457	312.1987	324.9959	348.9933	376.6200	398.5114	(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					7.3000	10.6334	0.6300	0.7000	0.7700			23.7228 (74)
East					0.6000	19.6403	0.6300	0.7000	0.7700			3.6014 (76)
South					8.3200	46.7521	0.6300	0.7000	0.7700			118.8765 (78)
West					3.6700	19.6403	0.6300	0.7000	0.7700			22.0285 (80)
Solar gains	168.2292	290.1621	407.6049	524.4554	606.3539	610.6120	585.0747	522.4413	447.7186	323.4489	202.1318	143.5735 (83)
Total gains	579.6188	700.1058	803.1395	896.1405	952.6050	933.3268	893.1204	834.6400	772.7145	672.4422	578.7518	542.0849 (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	58.3528	58.4949	58.6348	59.3011	59.4275	60.0229	60.0229	60.1344	59.7921	59.4275	59.1724	58.9081	
alpha	4.8902	4.8997	4.9090	4.9534	4.9618	5.0015	5.0015	5.0090	4.9861	4.9618	4.9448	4.9272	
util living area	0.9990	0.9971	0.9918	0.9731	0.9152	0.7790	0.6104	0.6679	0.8875	0.9843	0.9976	0.9993	(86)
MIT	19.6307	19.8004	20.0633	20.4052	20.7139	20.9164	20.9806	20.9701	20.8248	20.4175	19.9582	19.6031	(87)
Th 2	19.9279	19.9303	19.9325	19.9432	19.9452	19.9546	19.9546	19.9563	19.9510	19.9452	19.9412	19.9369	(88)
util rest of house	0.9986	0.9961	0.9888	0.9620	0.8784	0.6896	0.4783	0.5366	0.8251	0.9759	0.9966	0.9990	(89)
MIT 2	18.6774	18.8486	19.1117	19.4559	19.7451	19.9143	19.9495	19.9474	19.8494	19.4734	19.0151	18.6570	(90)
Living area fraction									fLA = Living area / (4) =				0.1192 (91)
MIT	18.7910	18.9620	19.2251	19.5690	19.8605	20.0337	20.0724	20.0693	19.9657	19.5859	19.1275	18.7698	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7910	18.9620	19.2251	19.5690	19.8605	20.0337	20.0724	20.0693	19.9657	19.5859	19.1275	18.7698	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9980	0.9948	0.9860	0.9569	0.8749	0.6972	0.4940	0.5519	0.8262	0.9719	0.9955	0.9986	(94)
Ext temp.	578.4739	696.4847	791.8617	857.5436	833.4024	650.6878	441.1893	460.6538	638.4138	653.5541	576.1572	541.3141	(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	1924.9305	1863.4079	1682.2300	1394.5758	1064.4161	701.7158	448.4216	472.9759	760.4180	1172.0648	1575.5630	1917.1525	(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	1001.7637	784.1724	662.4340	386.6632	171.8742	0.0000	0.0000	0.0000	0.0000	385.7719	719.5722	1023.6238	(98)
Space heating												5135.8754	(98)
Space heating per m ²										(98) / (4) =		46.0121	(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	1213.9219	955.6406	979.6479	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8293	0.9009	0.8736	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1006.6710	860.9271	855.7717	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1202.1009	1152.6727	1086.4072	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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	140.7095	217.0587	171.5928	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												529.3610 (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	35.1774	54.2647	42.8982	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												132.3402 (107)
Space cooling per m2												1.1856 (108)
Energy for space heating												46.0121 (99)
Energy for space cooling												1.1856 (108)
Total												47.1978 (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)			19.8900	1.2357	24.5789		(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)
Clad Cavity	146.1000	24.1900	121.9100	0.2400	29.2584	60.0000	7314.6000 (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) =		77.0303		(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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	21345.9600 (34)
	191.2378 (35)
	10.2115 (36)
(33) + (36) =	87.2418 (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	136.7273 136.2959 136.2959 135.6884 135.6884 134.9520 135.1282 134.7810 134.9520 135.3097 135.3097 135.8857 (39)
Average = Sum(39)m / 12 =	135.5845 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2249	1.2211	1.2211	1.2156	1.2156	1.2090	1.2106	1.2075	1.2090	1.2122	1.2122	1.2174 (40)
HLP (average)												1.2147 (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 Heat Demand 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)
RHI water heating demand												
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)
												1759 (64)
												1759 (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	62.4431	55.4614	45.1042	34.1468	25.5251	21.5494	23.2849	30.2666	40.6237	51.5811	60.2028	64.1785 (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	664.0358	658.9520	633.0394	592.7100	551.0650	514.0414	492.6015	501.9313	525.3211	565.8822	610.9604	645.4022 (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					7.3000	11.9814	0.4400	0.0000	0.7700		29.6330 (74)	
East					0.6000	22.3313		0.0000	0.7700		4.5395 (76)	
South					8.3200	50.9848	0.4400	0.0000	0.7700		143.7168 (78)	
West					3.6700	22.3313	0.4400	0.0000	0.7700		27.7667 (80)	
Solar gains	205.6560	319.4900	444.8536	593.4354	671.8336	725.5419	687.0731	624.8749	530.8284	380.6224	253.1901	173.8065 (83)
Total gains	869.6918	978.4419	1077.8930	1186.1454	1222.8985	1239.5832	1179.6746	1126.8062	1056.1495	946.5046	864.1505	819.2087 (84)

7. Mean internal temperature (heating season)

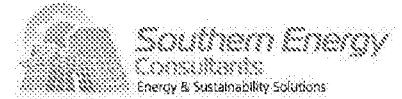
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.3669	43.5041	43.5041	43.6989	43.6989	43.9374	43.8801	43.9931	43.9374	43.8212	43.8212	43.6355
alpha	3.8911	3.9003	3.9003	3.9133	3.9133	3.9292	3.9253	3.9329	3.9292	3.9214	3.9214	3.9090
util living area	0.9828	0.9721	0.9457	0.8792	0.7465	0.5204	0.3511	0.3773	0.6645	0.8952	0.9677	0.9859 (86)
MIT	19.6592	19.8324	20.1513	20.5282	20.8242	20.9697	20.9952	20.9937	20.9175	20.5673	20.0595	19.6226 (87)
Th 2	19.9001	19.9032	19.9032	19.9075	19.9075	19.9128	19.9115	19.9140	19.9128	19.9102	19.9102	19.9061 (88)
util rest of house	0.9783	0.9649	0.9311	0.8465	0.6798	0.4173	0.2299	0.2520	0.5666	0.8591	0.9578	0.9821 (89)
MIT 2	18.1543	18.4054	18.8595	19.3797	19.7494	19.8967	19.9105	19.9126	19.8567	19.4455	18.7400	18.1058 (90)
Living area fraction									fLA = Living area / (4) =			0.1192 (91)
MIT	18.3336	18.5754	19.0135	19.5166	19.8775	20.0246	20.0398	20.0414	19.9831	19.5792	18.8972	18.2865 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1836	18.4254	18.8635	19.3666	19.7275	19.8746	19.8898	19.8914	19.8331	19.4292	18.7472	18.1365 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9680	0.9514	0.9130	0.8269	0.6674	0.4135	0.2274	0.2494	0.5587	0.8391	0.9429	0.9730 (94)
Useful gains	841.8710	930.8693	984.1097	980.8306	816.1564	512.5585	268.2501	280.9718	590.0680	794.1729	814.7915	797.1036 (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	1788.8900	1748.0494	1562.4243	1284.5033	912.8416	522.8798	268.8762	281.8812	625.2401	1059.3663	1454.2022	1771.4729 (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	704.5821	549.1450	430.2661	218.6443	71.9337	0.0000	0.0000	0.0000	0.0000	197.3039	460.3757	724.9307 (98)
Space heating												3357.1816 (98)
RHI space heating demand												3357 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)
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)			19.8900	1.2357	24.5789		(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)
Clad Cavity	146.1000	24.1900	121.9100	0.2400	29.2584	60.0000	7314.6000 (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) =		77.0303		(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) = 21345.9600 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 191.2378 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.2115 (36)
Total fabric heat loss (33) + (36) = 87.2418 (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	138.9286	138.6629	138.4026	137.1796	136.9508	135.8857	135.8857	135.6884	136.2959	136.9508	137.4137	137.8976 (39)
Average = Sum(39)m / 12 =												137.1785 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2447	1.2423	1.2399	1.2290	1.2269	1.2174	1.2174	1.2156	1.2211	1.2269	1.2311	1.2354 (40)
HLP (average)												1.2290 (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

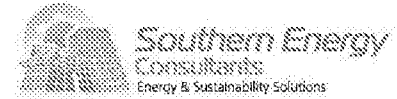
Elmhurst Energy Systems

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	62.4431	55.4614	45.1042	34.1468	25.5251	21.5494	23.2849	30.2666	40.6237	51.5811	60.2028	64.1785 (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	664.0358	658.9520	633.0394	592.7100	551.0650	514.0414	492.6015	501.9313	525.3211	565.8822	610.9604	645.4022 (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					7.3000	10.6334	0.4400	0.0000	0.7700	26.2989 (74)		
East					0.6000	19.6403	0.4400	0.0000	0.7700	3.9925 (76)		
South					8.3200	46.7521	0.4400	0.0000	0.7700	131.7855 (78)		
West					3.6700	19.6403	0.4400	0.0000	0.7700	24.4206 (80)		
Solar gains	186.4975	321.6713	451.8673	581.4069	672.1988	676.9194	648.6089	579.1741	496.3371	358.5727	224.0816	159.1644 (83)
Total gains	850.5333	980.6233	1084.9067	1174.1169	1223.2638	1190.9607	1141.2104	1081.1054	1021.6582	924.4549	835.0420	804.5666 (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	42.6797	42.7615	42.8419	43.2239	43.2961	43.6355	43.6355	43.6989	43.5041	43.2961	43.1502	42.9988
alpha	3.8453	3.8508	3.8561	3.8816	3.8864	3.9090	3.9090	3.9133	3.9003	3.8864	3.8767	3.8666
util living area	0.9865	0.9760	0.9549	0.9064	0.8111	0.6569	0.5031	0.5469	0.7617	0.9256	0.9768	0.9890 (86)
MIT	19.5012	19.7086	20.0164	20.3951	20.7140	20.9111	20.9758	20.9664	20.8350	20.4223	19.8892	19.4577 (87)
Th 2	19.8844	19.8863	19.8882	19.8969	19.8985	19.9061	19.9061	19.9075	19.9032	19.8985	19.8952	19.8918 (88)
util rest of house	0.9831	0.9699	0.9432	0.8813	0.7600	0.5687	0.3874	0.4301	0.6840	0.9002	0.9699	0.9862 (89)
MIT 2	17.9147	18.2151	18.6571	19.1921	19.6111	19.8409	19.8954	19.8912	19.7660	19.2419	18.4854	17.8564 (90)
Living area fraction	18.1037	18.3931	18.8191	19.3355	19.7425	19.9684	20.0241	20.0193	19.8933	19.3826	18.6527	18.0472 (92)
MIT	17.9537	18.2431	18.6691	19.1855	19.5925	19.8184	19.8741	19.8693	19.7433	19.2326	18.5027	17.8972 (93)
Temperature adjustment												-0.1500
adjusted MIT												17.8972 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9742	0.9573	0.9260	0.8611	0.7435	0.5610	0.3838	0.4258	0.6710	0.8801	0.9573	0.9785 (94)
Ext temp.	828.6146	938.7130	1004.6093	1011.0312	909.4720	668.0931	438.0067	460.3024	685.5348	813.6431	799.3855	787.2558 (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	1896.8899	1850.1913	1684.2316	1410.9586	1080.8837	709.1093	444.9061	470.7465	769.1649	1182.2406	1566.8867	1888.8156 (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 m2	794.7968	612.5134	505.6389	287.9477	127.5303	0.0000	0.0000	0.0000	0.0000	274.2365	552.6009	819.5604 (98)
												3974.8251 (98)
												(98) / (4) = 35.6103 (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													4392.0719	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	794.7968	612.5134	505.6389	287.9477	127.5303	0.0000	0.0000	0.0000	0.0000	274.2365	552.6009	819.5604	(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)	878.2285	676.8104	558.7170	318.1743	140.9175	0.0000	0.0000	0.0000	0.0000	303.0238	610.6087	905.5916	(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	89.8933	89.8273	89.6977	89.4094	88.8037	87.3000	87.3000	87.3000	87.3000	89.3468	89.7577	89.9224	(217)	
Fuel for water heating, kWh/month	199.5250	175.0723	181.9622	160.6238	156.2663	138.8084	130.2533	147.1558	148.2297	166.8249	179.3708	193.6496	(219)	
Water heating fuel used												1977.7420	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4392.0719	(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)													441.1055	(232)
Total delivered energy for all uses													6885.9194	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4392.0719	3.4800	152.8441 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1977.7420	3.4800	68.8254 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	441.1055	13.1900	58.1818 (250)
Additional standing charges			120.0000 (251)
Total energy cost			409.7438 (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] =	1.0988 (257)
SAP value		84.6719
SAP rating (Section 12)		85 (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	4392.0719	0.2160	948.6875 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1977.7420	0.2160	427.1923 (264)
Space and water heating			1375.8798 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.1055	0.5190	228.9338 (268)
Total kg/year			1643.7386 (272)
CO2 emissions per m2			14.7300 (273)
EI value			85.9366
EI rating			86 (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	$3.48 / 0.8882 = 3.918$, stars = 4
Water heating environmental impact	$0.216 / 0.8882 = 0.2432$, 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 * 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)			19.8900	1.2357	24.5789		(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)
Clad Cavity	146.1000	24.1900	121.9100	0.2400	29.2584	60.0000	7314.6000 (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) =		77.0303		(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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) =	21345.9600 (34)
	191.2378 (35)
	10.2115 (36)
(33) + (36) =	87.2418 (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	136.7273 136.2959 136.2959 135.6884 135.6884 134.9520 135.1282 134.7810 134.9520 135.3097 135.3097 135.8857 (39)
Average = Sum(39)m / 12 =	135.5845 (39)

HLP	Jan 1.2249 Feb 1.2211 Mar 1.2211 Apr 1.2156 May 1.2156 Jun 1.2090 Jul 1.2106 Aug 1.2075 Sep 1.2090 Oct 1.2122 Nov 1.2122 Dec 1.2174 (40)
HLP (average)	1.2147 (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 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	62.4431	55.4614	45.1042	34.1468	25.5251	21.5494	23.2849	30.2666	40.6237	51.5811	60.2028	64.1785 (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	664.0358	658.9520	633.0394	592.7100	551.0650	514.0414	492.6015	501.9313	525.3211	565.8822	610.9604	649.4022 (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	7.3000	11.9814	0.4400	0.0000	0.7700	29.6330 (74)
East	0.6000	22.3313	0.4400	0.0000	0.7700	4.5395 (76)
South	8.3200	50.9848	0.4400	0.0000	0.7700	143.7168 (78)
West	3.6700	22.3313	0.4400	0.0000	0.7700	27.7667 (80)

Solar gains	205.6560	319.4900	444.8536	593.4354	671.8336	725.5419	687.0731	624.8749	530.8284	380.6224	253.1901	173.8065 (83)
Total gains	869.6918	978.4419	1077.8930	1186.1454	1222.8985	1239.5832	1179.6746	1126.8062	1056.1495	946.5046	864.1505	819.2087 (84)

7. Mean internal temperature (heating season)

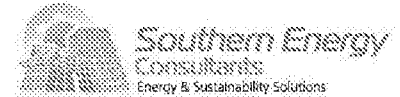
Temperature during heating periods in the living area from Table 9, Thl (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.3669	43.5041	43.5041	43.6989	43.6989	43.9374	43.8801	43.9931	43.9374	43.8212	43.8212	43.6355
alpha	3.8911	3.9003	3.9003	3.9133	3.9133	3.9292	3.9253	3.9329	3.9292	3.9214	3.9214	3.9090
util living area	0.9828	0.9721	0.9457	0.8792	0.7465	0.5204	0.3511	0.3773	0.6645	0.8952	0.9677	0.9859 (86)
MIT	19.6592	19.8324	20.1513	20.5282	20.8242	20.9697	20.9952	20.9937	20.9175	20.5673	20.0595	19.6226 (87)
Th 2	19.9001	19.9032	19.9032	19.9075	19.9075	19.9128	19.9115	19.9140	19.9128	19.9102	19.9102	19.9061 (88)
util rest of house	0.9783	0.9649	0.9311	0.8465	0.6798	0.4173	0.2299	0.2520	0.5666	0.8591	0.9578	0.9821 (89)
MIT 2	18.1543	18.4054	18.8595	19.3797	19.7494	19.8967	19.9105	19.9126	19.8567	19.4455	18.7400	18.1058 (90)
Living area fraction									fLA = Living area / (4) =			0.1192 (91)
MIT	18.3336	18.5754	19.0135	19.5166	19.8775	20.0246	20.0398	20.0414	19.9831	19.5792	18.8972	18.2865 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1836	18.4254	18.8635	19.3666	19.7275	19.8746	19.8898	19.8914	19.8331	19.4292	18.7472	18.1365 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9680	0.9514	0.9130	0.8269	0.6674	0.4135	0.2274	0.2494	0.5587	0.8391	0.9429	0.9730 (94)
Ext temp.	841.8710	930.8693	984.1097	980.8306	816.1564	512.5585	268.2501	280.9718	590.0680	794.1729	814.7915	797.1036 (95)
Heat loss rate W	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)
Month fracti	1788.8900	1748.0494	1562.4243	1284.5033	912.8416	522.8798	268.8762	281.8812	625.2401	1059.3663	1454.2022	1771.4729 (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	704.5821	549.1450	430.2661	218.6443	71.9337	0.0000	0.0000	0.0000	0.0000	197.3039	460.3757	724.9307 (98)
Space heating per m2												3357.1816 (98)
(98) / (4) = 30.0769 (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													3709.5930	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	704.5821	549.1450	430.2661	218.6443	71.9337	0.0000	0.0000	0.0000	0.0000	197.3039	460.3757	724.9307	(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)	778.5438	606.7901	475.4321	241.5959	79.4848	0.0000	0.0000	0.0000	0.0000	218.0153	508.7024	801.0284	(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	89.8319	89.7675	89.5968	89.2037	88.3667	87.3000	87.3000	87.3000	87.3000	89.0946	89.6486	89.8620	(216)	
(217)m	89.8319	89.7675	89.5968	89.2037	88.3667	87.3000	87.3000	87.3000	87.3000	89.0946	89.6486	89.8620	(217)	
Fuel for water heating, kWh/month	199.6615	175.1891	182.1671	160.9941	157.0391	138.8084	130.2533	147.1558	148.2297	167.2971	179.5891	193.7796	(219)	
Water heating fuel used												1980.1639	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3709.5930	(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)													441.1055	(232)
Total delivered energy for all uses													6205.8624	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3709.5930	3.8700	143.5612 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1980.1639	3.8700	76.6323 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	441.1055	18.9000	83.3689 (250)
Additional standing charges			93.0000 (251)
Total energy cost			410.7375 (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	3709.5930	0.2160	801.2721 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1980.1639	0.2160	427.7154 (264)
Space and water heating			1228.9875 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	441.1055	0.5190	228.9338 (268)
Total kg/year			1496.8463 (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	3709.5930	1.2200	4525.7034 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1980.1639	1.2200	2415.8000 (264)
Space and water heating			6941.5034 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	441.1055	3.0700	1354.1939 (268)
Primary energy kWh/year			8525.9474 (272)
Primary energy kWh/m2/year			76.3837 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
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 (12.8%)
U Solar photovoltaic panels	+ 8.5	-£ 345	-947 kg (72.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30	1.72 kg/m²	B 86 B 88
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	£98	£107	-£9
Mains gas	£313	£274	£39
Space heating	£251	£251	£0
Water heating	£77	£47	£30
Lighting	£83	£83	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£411	£36	£375
Total cost of uses	£411	£36	£375
Delivered energy	56 kWh/m²	31 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.5 tonnes	0.4 tonnes	1.1 tonnes
CO2 emissions per m²	13 kg/m²	3 kg/m²	10 kg/m²
Primary energy	76 kWh/m²	17 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	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)
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)			19.8900	1.2357	24.5789		(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)
Clad Cavity	146.1000	24.1900	121.9100	0.2400	29.2584	60.0000	7314.6000 (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) =		77.0303		(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)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K
Thermal bridges (Sum(L x Psi) calculated using Appendix K)
Total fabric heat loss

(28)...(30) + (32) + (32a)...(32e) = 21345.9600 (34)												
191.2378 (35)												
10.2115 (36)												
(33) + (36) = 87.2418 (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	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)
Average = Sum(39)m / 12 =	138.9286	138.6629	138.4026	137.1796	136.9508	135.8857	135.8857	135.6884	136.2959	136.9508	137.4137	137.8976 (39)
												137.1785 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.2447	1.2423	1.2399	1.2290	1.2269	1.2174	1.2174	1.2156	1.2211	1.2269	1.2311	1.2354 (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

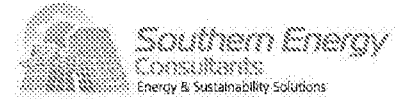
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF 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)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	62.4431	55.4614	45.1042	34.1468	25.5251	21.5494	23.2849	30.2666	40.6237	51.5811	60.2028	64.1785	(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	664.0358	658.9520	633.0394	592.7100	551.0650	514.0414	492.6015	501.9313	525.3211	565.8822	610.9604	645.4022	(73)

6. Solar gains

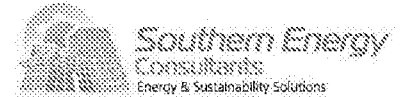
[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North				7.3000	10.6334		0.4400		0.0000		0.7700		26.2989 (74)
East				0.6000	19.6403		0.4400		0.0000		0.7700		3.9925 (76)
South				8.3200	46.7521		0.4400		0.0000		0.7700		131.7855 (78)
West				3.6700	19.6403		0.4400		0.0000		0.7700		24.4206 (80)
Solar gains	186.4975	321.6713	451.8673	581.4069	672.1988	676.9194	648.6089	579.1741	496.3371	358.5727	224.0816		159.1644 (83)
Total gains	850.5333	980.6233	1084.9067	1174.1169	1223.2638	1190.9607	1141.2104	1081.1054	1021.6582	924.4549	835.0420		804.5666 (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	42.6797	42.7615	42.8419	43.2239	43.2961	43.6355	43.6355	43.6989	43.5041	43.2961	43.1502	42.9988	
alpha	3.8453	3.8508	3.8561	3.8816	3.8864	3.9090	3.9090	3.9133	3.9003	3.8864	3.8767	3.8666	
util living area	0.9865	0.9760	0.9549	0.9064	0.8111	0.6569	0.5031	0.5469	0.7617	0.9256	0.9768	0.9890 (86)	
MIT	19.5012	19.7086	20.0164	20.3951	20.7140	20.9111	20.9758	20.9664	20.8350	20.4223	19.8892	19.4577 (87)	
Th 2	19.8844	19.8863	19.8882	19.8969	19.8985	19.9061	19.9061	19.9075	19.9032	19.8985	19.8952	19.8916 (88)	
util rest of house	0.9831	0.9699	0.9432	0.8813	0.7600	0.5687	0.3874	0.4301	0.6840	0.9002	0.9699	0.9862 (89)	
MIT 2	17.9147	18.2151	18.6571	19.1921	19.6111	19.8409	19.8954	19.8912	19.7660	19.2419	18.4854	17.8564 (90)	
Living area fraction									fLA = Living area / (4) =			0.1192 (91)	
MIT	18.1037	18.3931	18.8191	19.3355	19.7425	19.9684	20.0241	20.0193	19.8933	19.3826	18.6527	18.0472 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	17.9537	18.2431	18.6691	19.1855	19.5925	19.8184	19.8741	19.8693	19.7433	19.2326	18.5027	17.8972 (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	0.9742	0.9573	0.9260	0.8611	0.7435	0.5610	0.3838	0.4258	0.6710	0.8801	0.9573	0.9785	(94)
Useful gains	828.6146	938.7130	1004.6093	1011.0312	909.4720	668.0931	438.0067	460.3024	685.5348	813.6431	799.3855	787.2558	(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	1896.8899	1850.1913	1684.2316	1410.9586	1080.8837	709.1093	444.9061	470.7465	769.1649	1182.2406	1566.8867	1888.8156	(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	794.7968	612.5134	505.6389	287.9477	127.5303	0.0000	0.0000	0.0000	0.0000	274.2365	552.6009	819.5604	(98)
Space heating												3974.8251	(98)
Space heating per m2											(98) / (4) =	35.6103	(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													4392.0719 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	794.7968	612.5134	505.6389	287.9477	127.5303	0.0000	0.0000	0.0000	0.0000	274.2365	552.6009	819.5604	(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)	878.2285	676.8104	558.7170	318.1743	140.9175	0.0000	0.0000	0.0000	0.0000	303.0238	610.6087	905.5916	(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	89.9649	89.9792	89.9969	90.0384	90.0681	87.3000	87.3000	87.3000	87.3000	89.6555	89.8693	89.9815	(217)
Fuel for water heating, kWh/month	171.1204	127.6501	101.1108	52.0052	21.3136	4.1464	0.0000	31.0558	57.3001	105.7877	145.6088	169.8897	(219)
Water heating fuel used												986.9887	(219)
Annual totals kWh/year													
Space heating fuel - main system												4392.0719	(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)													441.1055 (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												4217.9267	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4392.0719	3.4800	152.8441	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	986.9887	3.4800	34.3472	(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	441.1055	13.1900	58.1818	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			154.0378	(255)

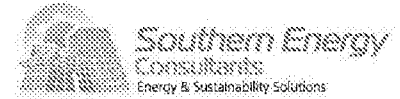
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4131 (257)
SAP value		94.2376
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	4392.0719	0.2160	948.6875 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	986.9887	0.2160	213.1896 (264)
Space and water heating			1161.8771 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	441.1055	0.5190	228.9338 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			559.2486 (272)
CO2 emissions per m2			5.0100 (273)
EI value			95.2152
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	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	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)			19.8900	1.2357	24.5789		(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)
Clad Cavity	146.1000	24.1900	121.9100	0.2400	29.2584	60.0000	7314.6000 (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) =		77.0303		(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) = 21345.9600 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 191.2378 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 10.2115 (36)
 Total fabric heat loss (33) + (36) = 87.2418 (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	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)
Heat transfer coeff	136.7273	136.2959	136.2959	135.6884	135.6884	134.9520	135.1282	134.7810	134.9520	135.3097	135.3097	135.8857 (39)
Average = Sum(39)m / 12 =												135.5845 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2249	1.2211	1.2211	1.2156	1.2156	1.2090	1.2106	1.2075	1.2090	1.2122	1.2122	1.2174 (40)
HLP (average)												1.2147 (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)

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	62.4431	55.4614	45.1042	34.1468	25.5251	21.5494	23.2849	30.2666	40.6237	51.5811	60.2028	64.1785	(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	664.0358	658.9520	633.0394	592.7100	551.0650	514.0414	492.6015	501.9313	525.3211	565.8822	610.9604	645.4022	(73)

6. Solar gains

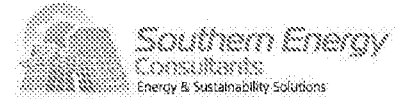
[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North				7.3000	11.9814	0.4400		0.0000		0.7700	29.6330 (74)	
East				0.6000	22.3313	0.4400		0.0000		0.7700	4.5395 (76)	
South				8.3200	50.9848	0.4400		0.0000		0.7700	143.7168 (78)	
West				3.6700	22.3313	0.4400		0.0000		0.7700	27.7667 (80)	
Solar gains	205.6560	319.4900	444.8536	593.4354	671.8336	725.5419	687.0731	624.8749	530.8284	380.6224	253.1901	173.8065 (83)
Total gains	869.6918	978.4419	1077.8930	1186.1454	1222.8985	1239.5832	1179.6746	1126.8062	1056.1495	946.5046	864.1505	819.2087 (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	43.3669	43.5041	43.5041	43.6989	43.6989	43.9374	43.8801	43.9931	43.9374	43.8212	43.8212	43.6355
alpha	3.8911	3.9003	3.9003	3.9133	3.9133	3.9292	3.9253	3.9329	3.9292	3.9214	3.9214	3.9090
util living area	0.9828	0.9721	0.9457	0.8792	0.7465	0.5204	0.3511	0.3773	0.6645	0.8952	0.9677	0.9859 (86)
MIT	19.6592	19.8324	20.1513	20.5282	20.8242	20.9697	20.9952	20.9937	20.9175	20.5673	20.0595	19.6226 (87)
Th 2	19.9001	19.9032	19.9032	19.9075	19.9075	19.9128	19.9115	19.9140	19.9128	19.9102	19.9102	19.9061 (88)
util rest of house	0.9783	0.9649	0.9311	0.8465	0.6798	0.4173	0.2299	0.2520	0.5666	0.8591	0.9578	0.9821 (89)
MIT 2	18.1543	18.4054	18.8595	19.3797	19.7494	19.8967	19.9105	19.9126	19.8567	19.4455	18.7400	18.1058 (90)
Living area fraction									fLA = Living area / (4) =			0.1192 (91)
MIT	18.3336	18.5754	19.0135	19.5166	19.8775	20.0246	20.0398	20.0414	19.9831	19.5792	18.8972	18.2865 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1836	18.4254	18.8635	19.3666	19.7275	19.8746	19.8898	19.8914	19.8331	19.4292	18.7472	18.1365 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9680	0.9514	0.9130	0.8269	0.6674	0.4135	0.2274	0.2494	0.5587	0.8391	0.9429	0.9730	(94)
Useful gains	841.8710	930.8693	984.1097	980.8306	816.1564	512.5585	268.2501	280.9718	590.0680	794.1729	814.7915	797.1036	(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													
	1788.8900	1748.0494	1562.4243	1284.5033	912.8416	522.8798	268.8762	281.8812	625.2401	1059.3663	1454.2022	1771.4729	(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													
	704.5821	549.1450	430.2661	218.6443	71.9337	0.0000	0.0000	0.0000	0.0000	197.3039	460.3757	724.9307	(98)
Space heating													
Space heating per m2													(98) / (4) = 30.0769 (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													3709.5930 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	704.5821	549.1450	430.2661	218.6443	71.9337	0.0000	0.0000	0.0000	0.0000	197.3039	460.3757	724.9307	(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)	778.5438	606.7901	475.4321	241.5959	79.4848	0.0000	0.0000	0.0000	0.0000	218.0153	508.7024	801.0284	(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	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)
Efficiency of water heater	89.9157	89.9255	89.9114	89.9136	89.7084	87.3000	87.3000	87.3000	87.3000	89.4529	89.7860	89.9307	(217)
Fuel for water heating, kWh/month	168.8702	128.8866	104.0570	52.6346	25.4249	0.0000	0.0000	25.3116	53.1299	103.4895	142.0591	168.2793	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3709.5930 (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)													441.1055 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)
Total delivered energy for all uses													3423.6817 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3709.5930	3.8700	143.5612	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	972.1428	3.8700	37.6219	(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	441.1055	18.9000	83.3689	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			36.4109	(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	3709.5930	0.2160	801.2721	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	972.1428	0.2160	209.9829	(264)
Space and water heating			1011.2549	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	441.1055	0.5190	228.9338	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

Regs Region: England

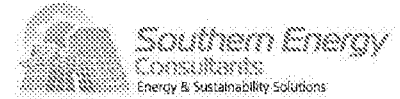
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Total kg/year 358.3248 (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	3709.5930	1.2200	4525.7034 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	972.1428	1.2200	1186.0143 (264)
Space and water heating			5711.7177 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	441.1055	3.0700	1354.1939 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1849.4915 (272)
Primary energy kWh/m2/year			16.5695 (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	North
Overshading	Average or unknown
Thermal mass parameter	191.2 (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	87.24 (37)
Summer heat loss coefficient	446.01 (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	7.3000	81.1852	0.4400	0.0000	0.9000	234.6901
East	0.6000	117.5071	0.4400	0.0000	0.9000	27.9197
South	8.3200	112.2060	0.4400	0.0000	0.9000	369.6873
West	3.6700	117.5071	0.4400	0.0000	0.9000	170.7754
total:						803.0725

	Jun	Jul	Aug	
Solar gains	848	803	730	(P4)
Internal gains	511	490	499	
Total summer gains	1359	1293	1229	(P5)
Summer gain/loss ratio	3.05	2.90	2.76	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 191.2)	0.66	0.66	0.66	
Threshold temperature	19.71	21.46	21.22	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			