

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG008e		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Sem Bri Ga Ea		
Property	WP3520A+, Plot 73				
SAP Rating	84 B	DER	17.32	TET	17.96
Environmental	36 B	% DER<TER	3.58		
CO ₂ Emissions (t/year)	1.32	DPEE	47.79	TPEE	51.36
General Requirements Compliance	Pass	% DPEE<TPEE	6.96		
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

Semi-Detached House, total floor area 93 m²

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

1a TER and DER

Fuel for main heating: Mains gas
Fuel factor: 1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.96 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.32 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 51.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 47.8 kWh/m²/yr OK

2 Fabric U-values

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

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

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

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2854 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	51.5936		(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss							(33) + (36) = 60.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	103.7975	103.5996	103.4056	102.4946	102.3241	101.5306	101.5306	101.3837	101.8363	102.3241	102.6689	103.0294 (39)
Average = Sum(39)m / 12 =												102.4938 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1123	1.1102	1.1081	1.0983	1.0965	1.0880	1.0880	1.0864	1.0913	1.0965	1.1002	1.1040 (40)
HLP (average)												1.0983 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (64)
Total per year (kWh/year) = Sum(64)m =											1700.7860 (64)
Heat gains from water heating, kWh/month											
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6499	22.7821	18.5276	14.0266	10.4850	8.8519	9.5648	12.4327	16.6871	21.1882	24.7297	26.3628	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	412.6191	410.0361	394.6839	370.1622	345.2579	321.6098	306.5581	313.2316	326.1523	350.8970	379.1099	400.2709	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.6000	10.6334	0.4400	0.0000	0.7700		2.1616 (74)	
East					3.4900	19.6403	0.4400	0.0000	0.7700		23.2229 (76)	
West					4.5200	19.6403	0.4400	0.0000	0.7700		30.0766 (80)	
Solar gains	55.4611	108.3960	178.7292	261.7034	322.0978	330.4361	314.2892	268.9738	208.1452	128.6366	69.1248	45.6329 (83)
Total gains	468.0802	518.4321	573.4131	631.8656	667.3557	652.0459	620.8473	582.2054	534.2975	479.5336	448.2347	445.9038 (84)

7. Mean internal temperature (heating season)

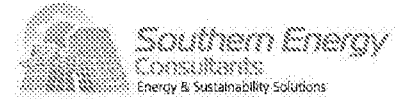
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.4705	50.5669	50.6617	51.1120	51.1972	51.5973	51.5973	51.6721	51.4424	51.1972	51.0252	50.8467
alpha	4.3647	4.3711	4.3774	4.4075	4.4131	4.4398	4.4398	4.4448	4.4295	4.4131	4.4017	4.3898
util living area	0.9976	0.9958	0.9908	0.9742	0.9269	0.8148	0.6634	0.7162	0.9080	0.9835	0.9958	0.9981 (86)
MIT	19.4856	19.6222	19.8854	20.2509	20.6004	20.8575	20.9581	20.9406	20.7387	20.2890	19.8242	19.4597 (87)
Th 2	19.9908	19.9925	19.9942	20.0022	20.0037	20.0107	20.0107	20.0119	20.0080	20.0037	20.0007	19.9975 (88)
util rest of house	0.9969	0.9946	0.9879	0.9653	0.8987	0.7402	0.5385	0.5967	0.8607	0.9762	0.9944	0.9975 (89)
MIT 2	17.9557	18.1564	18.5412	19.0747	19.5645	19.8933	19.9896	19.9788	19.7586	19.1354	18.4576	17.9223 (90)
Living area fraction	18.2806	18.4677	18.8267	19.3245	19.7845	20.0981	20.1953	20.1831	19.9668	19.3804	18.7478	18.2488 (91)
MIT	18.1306	18.3177	18.6767	19.1745	19.6345	19.9481	20.0453	20.0331	19.8168	19.2304	18.5978	18.0988 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9949	0.9915	0.9823	0.9551	0.8854	0.7347	0.5433	0.5995	0.8490	0.9680	0.9912	0.9959 (94)
Useful gains	465.7052	514.0486	563.2845	603.4695	590.8767	479.0814	337.2926	349.0606	453.6306	464.1652	444.2964	444.0684 (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	1435.5854	1390.0716	1259.1401	1053.0830	811.8920	542.9926	349.8021	368.3373	582.1725	883.1019	1180.4708	1431.9908 (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	721.5909	588.6875	517.7166	323.7217	164.4354	0.0000	0.0000	0.0000	0.0000	311.6889	530.0456	735.0143 (98)
Space heating												3892.9008 (98)
Space heating per m2												(98) / (4) = 41.7156 (99)

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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													4301.5478 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	721.5909	588.6875	517.7166	323.7217	164.4354	0.0000	0.0000	0.0000	0.0000	311.6889	530.0456	735.0143	(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)	797.3380	650.4834	572.0625	357.7036	181.6966	0.0000	0.0000	0.0000	0.0000	344.4076	585.6857	812.1705	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)
Efficiency of water heater (217)m	89.8621	89.8244	89.7318	89.5151	89.0335	87.3000	87.3000	87.3000	87.3000	89.4632	89.7534	89.8862	(216)
Fuel for water heating, kWh/month	192.8648	169.1898	175.8088	155.1064	150.7244	134.2869	126.0634	142.3470	143.3625	161.0837	173.3707	187.2120	(219)
Water heating fuel used												1911.4204	(219)
Annual totals kWh/year													
Space heating fuel - main system													4301.5478 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													452.9861 (232)
Total delivered energy for all uses													6740.9543 (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	4301.5478	0.2160	929.1343 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1911.4204	0.2160	412.8668 (264)
Space and water heating			1342.0011 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total CO2, kg/year			1616.0259 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.3200 (273)

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

DER		17.3200 ZC1
Total Floor Area	TFA	93.3200
Assumed number of occupants	N	2.6685
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.5609 ZC2
CO2 emissions from cooking, equation (L16)		1.9615 ZC3
Total CO2 emissions		34.8424 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		34.8424 ZC8

Southern Energy
Consultants
Energy & Sustainability Solutions

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	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (25)

[illegible]

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If cylinder contains dedicated solar storage												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.7185	47.1576	46.7406	43.3080	44.7516	46.7406	47.1576	50.7185	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month												
210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum (63)m = 0.0000 (63)												
Output from w/h												
210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	(64)
Total per year (kWh/year) = Sum (64)m = 2109.8143 (64)												
Heat gains from water heating, kWh/month												
65.6650	57.7956	60.4455	53.4328	51.6430	45.3076	43.1393	48.3498	48.8919	55.9191	59.5280	63.9950	(65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6499	22.7821	18.5276	14.0266	10.4850	8.8519	9.5648	12.4327	16.6871	21.1882	24.7297	26.3628	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	88.2594	86.0054	81.2439	74.2123	69.4127	62.9272	57.9829	64.9863	67.9055	75.1600	82.6778	86.0148	(72)
Total internal gains	424.9916	422.4126	406.9886	381.8140	356.2523	331.9489	316.9050	324.2334	337.8151	363.2126	391.4924	412.6474	(73)

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North												0.6000	10.6334	0.6300	0.7000	0.7700	1.9498 (74)
East												3.4900	19.6403	0.6300	0.7000	0.7700	20.9481 (76)
West												4.5200	19.6403	0.6300	0.7000	0.7700	27.1305 (80)
Solar gains	50.0284	97.7781	161.2218	236.0684	290.5469	298.0683	283.5032	242.6266	187.7564	116.0361	62.3537	41.1630	(83)				
Total gains	475.0200	520.1907	568.2105	617.8824	646.7992	630.0173	600.4082	566.8600	525.5715	479.2486	453.8461	453.8103	(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	66.0623	66.2322	66.3996	67.1972	67.3486	68.0623	68.0623	68.1961	67.7856	67.3486	67.0431	66.7266		
alpha	5.4042	5.4155	5.4266	5.4798	5.4899	5.5375	5.5375	5.5464	5.5190	5.4899	5.4695	5.4484		
util living area	0.9991	0.9983	0.9958	0.9853	0.9469	0.8326	0.6660	0.7201	0.9249	0.9908	0.9982	0.9993	(86)	
MIT	19.8075	19.9172	20.1287	20.4261	20.7095	20.9126	20.9803	20.9701	20.8213	20.4590	20.0847	19.7903	(87)	
Th 2	20.0409	20.0431	20.0453	20.0556	20.0575	20.0664	20.0664	20.0681	20.0630	20.0575	20.0536	20.0495	(88)	
util rest of house	0.9988	0.9978	0.9941	0.9790	0.9218	0.7562	0.5405	0.5983	0.8788	0.9858	0.9975	0.9991	(89)	
MIT 2	18.4353	18.5974	18.9077	19.3464	19.7441	19.9999	20.0581	20.0539	19.8998	19.3982	18.8502	18.4164	(90)	
Living area fraction	18.7267	18.8777	19.1670	19.5757	19.9491	20.1937	20.2540	20.2485	20.0955	19.6235	19.1124	18.7082	(92)	
Temperature adjustment	18.7267	18.8777	19.1670	19.5757	19.9491	20.1937	20.2540	20.2485	20.0955	19.6235	19.1124	18.7082	(93)	
adjusted MIT	18.7267	18.8777	19.1670	19.5757	19.9491	20.1937	20.2540	20.2485	20.0955	19.6235	19.1124	18.7082	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9967	0.9920	0.9747	0.9182	0.7680	0.5672	0.6238	0.8808	0.9825	0.9964	0.9986	(94)
Useful gains	474.1543	518.4701	563.6599	602.2566	593.8690	483.8624	340.5779	353.6100	462.9286	470.8496	452.2199	453.1685	(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	1415.2268	1367.6650	1236.2931	1029.5730	793.7663	532.6087	347.9141	365.7124	573.1904	868.2765	1161.1522	1409.0483	(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	700.1579	570.6590	500.4391	307.6678	148.7236	0.0000	0.0000	0.0000	0.0000	295.6856	510.4312	711.1745	(98)
Space heating												3744.9388	(98)
Space heating per m ²												40.1301	(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													4009.5705 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	700.1579	570.6590	500.4391	307.6678	148.7236	0.0000	0.0000	0.0000	0.0000	295.6856	510.4312	711.1745	(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)	749.6337	610.9839	535.8021	329.4088	159.2330	0.0000	0.0000	0.0000	0.0000	316.5799	546.5003	761.4288	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	210.1326	185.2418	194.3752	172.4010	166.9146	147.0091	140.8459	157.0102	158.7442	180.7619	191.2676	205.1102	(64)
Efficiency of water heater (217)m	87.8493	87.6969	87.3272	86.4932	84.7622	80.3000	80.3000	80.3000	80.3000	86.2826	87.4034	87.9244	(216)
Fuel for water heating, kWh/month	239.1967	211.2296	222.5826	199.3233	196.9212	183.0748	175.3996	195.5295	197.6889	209.4998	218.8331	233.2800	(219)
Water heating fuel used												2482.5589	(219)
Annual totals kWh/year													
Space heating fuel - main system													4009.5705 (211)
Space heating fuel - secondary													0.0000 (215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
Total electricity for the above, kWh/year													75.0000 (231)
Electricity for lighting (calculated in Appendix L)													452.9861 (232)
Total delivered energy for all uses													7020.1155 (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	4009.5705	0.2160	866.0672 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2482.5589	0.2160	536.2327 (264)
Space and water heating			1402.3000 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total CO2, kg/m2/year			1676.3247 (272)
Emissions per m2 for space and water heating			15.0268 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5193 (272b)
Emissions per m2 for pumps and fans			0.4171 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0268 * 1.00) + 2.5193 + 0.4171, rounded to 2 d.p.			17.9600 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.3218 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.5936			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			9.0000	419.9400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				18439.4000 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							197.5932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss			(33) + (36) =				60.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922	41.9053	42.4808	43.1012	43.5397	43.9981 (38)
Heat transfer coeff	105.1818	104.9301	104.6835	103.5250	103.3082	102.2992	102.2992	102.1123	102.6878	103.3082	103.7467	104.2051 (39)
Average = Sum(39)m / 12 =												103.5239 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1271	1.1244	1.1218	1.1094	1.1070	1.0962	1.0962	1.0942	1.1004	1.1070	1.1117	1.1166 (40)
HLP (average)												1.1093 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.8244	29.5831	30.5271	26.6142	25.5370	22.0365	20.4200	23.4323	23.7121	27.6342	30.1649	32.7571 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6499	22.7821	18.5276	14.0266	10.4850	8.8519	9.5648	12.4327	16.6871	21.1882	24.7297	26.3628	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	45.4629	44.0224	41.0310	36.9642	34.3239	30.6062	27.4463	31.4950	32.9335	37.1428	41.8957	44.0284	(72)
Total internal gains	379.1951	377.4296	363.7757	341.5659	318.1636	296.6279	283.3684	287.7421	299.8431	322.1953	347.7103	367.6610	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			0.6000		10.6334		0.4400		0.0000		0.7700		2.1616 (74)
East			3.4900		19.6403		0.4400		0.0000		0.7700		23.2229 (76)
West			4.5200		19.6403		0.4400		0.0000		0.7700		30.0766 (80)
Solar gains	55.4611	108.3960	178.7292	261.7034	322.0978	330.4361	314.2892	268.9738	208.1452	128.6366	69.1248	45.6329	(83)
Total gains	434.6562	485.8256	542.5049	603.2693	640.2614	627.0640	597.6576	556.7159	507.9883	450.8319	416.8351	413.2939	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	48.6972	48.8140	48.9290	49.4765	49.5803	50.0694	50.0694	50.1610	49.8799	49.5803	49.3708	49.1536	
alpha	4.2465	4.2543	4.2619	4.2984	4.3054	4.3380	4.3380	4.3441	4.3253	4.3054	4.2914	4.2769	
util living area	0.9980	0.9964	0.9920	0.9771	0.9342	0.8298	0.6834	0.7381	0.9191	0.9861	0.9965	0.9984	(86)
MIT	19.3964	19.5379	19.8108	20.1928	20.5584	20.8359	20.9492	20.9282	20.7053	20.2330	19.7511	19.3741	(87)
Th 2	19.9788	19.9809	19.9831	19.9932	19.9951	20.0039	20.0039	20.0056	20.0005	19.9951	19.9913	19.9873	(88)
util rest of house	0.9974	0.9954	0.9895	0.9692	0.9084	0.7582	0.5579	0.6196	0.8762	0.9799	0.9954	0.9980	(89)
MIT 2	18.5051	18.6480	18.9215	19.3071	19.6598	19.9095	19.9859	19.9772	19.8044	19.3512	18.8691	18.4894	(90)
Living area fraction	18.6944	18.8370	19.1103	19.4952	19.8507	20.1062	20.1905	20.1792	19.9957	19.5385	19.0564	18.6773	(91)
MIT	18.6944	18.8370	19.1103	19.4952	19.8507	20.1062	20.1905	20.1792	19.9957	19.5385	19.0564	18.6773	(92)
Temperature adjustment	18.6944	18.8370	19.1103	19.4952	19.8507	20.1062	20.1905	20.1792	19.9957	19.5385	19.0564	18.6773	(93)
adjusted MIT	18.6944	18.8370	19.1103	19.4952	19.8507	20.1062	20.1905	20.1792	19.9957	19.5385	19.0564	18.6773	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	433.1064	482.8305	535.2164	581.5746	578.6981	480.7556	348.7939	357.8441	444.9541	440.0606	414.2587	412.1117	(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	1514.0239	1462.4104	1320.0938	1096.8655	842.0318	563.2841	367.3019	385.8993	605.4206	923.4157	1240.4358	1508.6100	(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	804.2026	658.2777	583.9488	371.0094	195.9203	0.0000	0.0000	0.0000	0.0000	359.6162	594.8475	815.7948	(98)
Space heating												4383.6174	(98)
Space heating per m2												46.9740	(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	961.6121	757.0138	776.0535	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

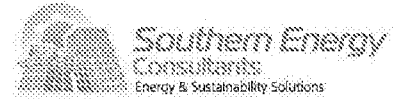


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7517	0.8341	0.8009	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	722.8311	631.4246	621.5312	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	835.7741	799.3854	753.8424	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	81.3189	124.9629	98.4395	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												304.7213 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	20.3297	31.2407	24.6099	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												76.1803 (107)
Space cooling per m2												0.8163 (108)
Energy for space heating												46.9740 (99)
Energy for space cooling												0.8163 (108)
Total												47.7904 (109)
Dwelling Fabric Energy Efficiency (DFEE)												47.8 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1286 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3786 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.3218 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate	0.4103	0.4023	0.3942	0.3540	0.3459	0.3057	0.3057	0.2977	0.3218	0.3459	0.3620	0.3781 (22b)
Effective ac	0.5842	0.5809	0.5777	0.5627	0.5598	0.5467	0.5467	0.5443	0.5518	0.5598	0.5655	0.5715 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
Heat Loss Floor 1			46.6600	0.1300	6.0658		(28a)
Brick Cavity	96.8000	12.9100	83.8900	0.1800	15.1002		(29a)
External Roof 1	46.6600		46.6600	0.1300	6.0658		(30)
Total net area of external elements Aum(A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	43.3766		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7463 (36)
Total fabric heat loss						(33) + (36) =	53.1229 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922	41.9053	42.4808	43.1012	43.5397	43.9981 (38)
Average = Sum(39)m / 12 =	98.0977	97.8460	97.5994	96.4408	96.2241	95.2150	95.2150	95.0282	95.6037	96.2241	96.6626	97.1210 (39)
												96.4398 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.0512	1.0485	1.0459	1.0334	1.0311	1.0203	1.0203	1.0183	1.0245	1.0311	1.0358	1.0407 (40)
Days in month												1.0334 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.6685 (42)
Average daily hot water use (litres/day)												97.5767 (43)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.8244	29.5831	30.5271	26.6142	25.5370	22.0365	20.4200	23.4323	23.7121	27.6342	30.1649	32.7571 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6499	22.7821	18.5276	14.0266	10.4850	8.8519	9.5648	12.4327	16.6871	21.1882	24.7297	26.3628	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	245.0548	247.5977	241.1897	227.5478	210.3273	194.1424	183.3300	180.7871	187.1951	200.8370	218.0575	234.2424	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	36.3425	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	45.4629	44.0224	41.0310	36.9642	34.3239	30.6062	27.4463	31.4950	32.9335	37.1428	41.6957	44.0284	(72)
Total internal gains	379.1951	377.4296	363.7757	341.5659	318.1636	296.6279	283.3684	287.7421	299.8431	322.1953	347.7103	367.6610	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6000	10.6334	0.6300	0.7000	0.7700	1.9498 (74)
East	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481 (76)
West	4.5200	19.6403	0.6300	0.7000	0.7700	27.1305 (80)

Solar gains	50.0284	97.7781	161.2218	236.0684	290.5469	298.0683	283.5032	242.6266	187.7564	116.0361	62.3537	41.1630	(83)
Total gains	429.2235	475.2077	524.9975	577.6343	608.7105	594.6963	566.8716	530.3687	487.5995	438.2314	410.0640	408.8240	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	66.0623	66.2322	66.3996	67.1972	67.3486	68.0623	68.0623	68.1961	67.7856	67.3486	67.0431	66.7266	
alpha	5.4042	5.4155	5.4266	5.4798	5.4899	5.5375	5.5375	5.5464	5.5190	5.4899	5.4695	5.4484	
util living area	0.9995	0.9989	0.9971	0.9892	0.9580	0.8572	0.6971	0.7551	0.9428	0.9939	0.9989	0.9996	(86)
MIT	19.7607	19.8715	20.0852	20.3876	20.6793	20.8973	20.9755	20.9622	20.7941	20.4186	20.0401	19.7442	(87)
Th 2	20.0409	20.0431	20.0453	20.0556	20.0575	20.0664	20.0664	20.0681	20.0630	20.0575	20.0536	20.0495	(88)
util rest of house	0.9993	0.9986	0.9960	0.9844	0.9370	0.7855	0.5697	0.6338	0.9044	0.9905	0.9985	0.9995	(89)
MIT 2	18.8980	19.0104	19.2255	19.5340	19.8169	20.0114	20.0591	20.0553	19.9300	19.5679	19.1875	18.8885	(90)
Living area fraction													(91)
MIT	19.0812	19.1933	19.4081	19.7153	20.0001	20.1996	20.2537	20.2479	20.1136	19.7486	19.3686	19.0702	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0812	19.1933	19.4081	19.7153	20.0001	20.1996	20.2537	20.2479	20.1136	19.7486	19.3686	19.0702	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9990	0.9981	0.9949	0.9821	0.9354	0.7973	0.5971	0.6596	0.9071	0.9890	0.9980	0.9993	(94)
Useful gains	428.8034	474.2993	522.3369	567.2985	569.3657	474.1241	338.5070	349.8355	442.2810	433.3984	409.2578	408.5214	(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	1450.0023	1398.5426	1259.8232	1043.0380	798.6686	533.1638	347.8916	365.6590	574.9178	880.3133	1185.9141	1444.2120	(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	759.7720	621.0915	548.6883	342.5324	170.6014	0.0000	0.0000	0.0000	0.0000	332.5047	559.1925	770.5538	(98)
Space heating												4104.9366	(98)
Space heating per m2												(98) / (4) =	43.9877 (99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W	0.0000	0.0000	0.0000	0.0000	0.0000	895.0214	704.5913	722.2142	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7945	0.8788	0.8477	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	711.1265	619.2248	612.2443	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	797.9417	763.4017	723.0469	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	62.5069	107.2676	82.4372	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

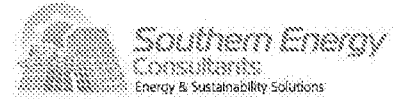


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												252.2118 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)	
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	15.6267	26.8169	20.6093	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												63.0529 (107)
Space cooling per m2												0.6757 (108)
Energy for space heating												43.9877 (99)
Energy for space cooling												0.6757 (108)
Total												44.6634 (109)
Target Fabric Energy Efficiency (TFEE)												51.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2854 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.5936		(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss						(33) + (36) =	60.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	102.1576	101.8363	101.8363	101.3837	101.3837	100.8351	100.9664	100.7077	100.8351	101.1016	101.1016	101.5306 (39)
Average = Sum(39)m / 12 =												101.3063 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0947	1.0913	1.0913	1.0864	1.0864	1.0805	1.0819	1.0792	1.0805	1.0834	1.0834	1.0880 (40)
HLP (average)												1.0856 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (64)
RHI water heating demand											
Heat gains from water heating, kWh/month											
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869 (65)

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5												
	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5												
	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5												
	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)												
	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397 (71)
Water heating gains (Table 5)												
	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383 (72)
Total internal gains												
	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				0.6000	11.9814	0.4400	0.0000	0.7700		2.4356 (74)		
East				3.4900	22.3313	0.4400	0.0000	0.7700		26.4048 (76)		
West				4.5200	22.3313	0.4400	0.0000	0.7700		34.1976 (80)		

Solar gains	63.0380	110.8644	180.3284	271.4341	324.8426	356.3636	335.3926	293.9655	227.4225	140.4269	80.4983	51.3588 (83)
Total gains	678.8526	721.0466	765.6205	818.7338	833.4440	830.8956	790.6166	758.9124	714.8280	666.0477	648.1261	650.5690 (84)

7. Mean internal temperature (heating season)

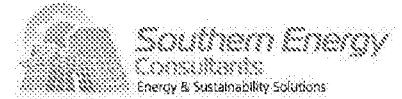
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	51.2806	51.4424	51.4424	51.6721	51.6721	51.9532	51.8856	52.0189	51.9532	51.8163	51.8163	51.5973
alpha	4.4187	4.4295	4.4295	4.4448	4.4448	4.4635	4.4590	4.4679	4.4635	4.4544	4.4544	4.4398
util living area	0.9876	0.9825	0.9663	0.9195	0.8051	0.5793	0.3920	0.4193	0.7270	0.9283	0.9778	0.9894 (86)
MIT	19.8550	19.9671	20.2250	20.5520	20.8315	20.9725	20.9963	20.9951	20.9215	20.6004	20.1811	19.8332 (87)
Th 2	20.0052	20.0080	20.0080	20.0119	20.0119	20.0168	20.0156	20.0179	20.0168	20.0144	20.0144	20.0107 (88)
util rest of house	0.9842	0.9777	0.9565	0.8950	0.7462	0.4771	0.2696	0.2934	0.6353	0.9009	0.9706	0.9864 (89)
MIT 2	18.5028	18.6668	19.0375	19.4970	19.8552	20.0017	20.0148	20.0167	19.9611	19.5727	18.9824	18.4752 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.7900	18.9430	19.2897	19.7211	20.0626	20.2079	20.2233	20.2245	20.1651	19.7910	19.2370	18.7636 (92)
Temperature adjustment												
adjusted MIT	18.6400	18.7930	19.1397	19.5711	19.9126	20.0579	20.0733	20.0745	20.0151	19.6410	19.0870	18.6136 (93)

8. Space heating requirement

Utilisation	0.9776	0.9695	0.9452	0.8816	0.7395	0.4816	0.2769	0.3008	0.6351	0.8878	0.9613	0.9805 (94)
Useful gains	663.6446	699.0838	723.6468	721.8086	616.3155	400.1921	218.9044	228.3012	454.0133	591.3161	623.0391	637.8961 (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	1383.2158	1343.5234	1195.5253	980.4869	700.8238	409.1744	219.4271	229.0600	485.5295	812.9560	1120.9116	1372.0443 (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	535.3610	433.0634	351.0776	186.2484	62.8742	0.0000	0.0000	0.0000	0.0000	164.9001	358.4682	546.2062 (98)
Space heating												2638.1990 (98)
RHI space heating demand												2638 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2854 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.5936			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	18859.3400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss			(33) + (36) =	60.2070			(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	103.7975	103.5996	103.4056	102.4946	102.3241	101.5306	101.5306	101.3837	101.8363	102.3241	102.6689	103.0294 (39)
Average = Sum(39)m / 12 =												102.4938 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1123	1.1102	1.1081	1.0983	1.0965	1.0880	1.0880	1.0864	1.0913	1.0965	1.1002	1.1040 (40)
HLP (average)												1.0983 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761 20.8822 21.5485 18.7865 18.0261 15.5552 14.4141 16.5404 16.7380 19.5065 21.2929 23.1227 (46)											
Water storage loss:											
Total storage loss											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)											
If cylinder contains dedicated solar storage											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)											
Combi loss 14.1386 12.7594 14.0997 13.6002 14.0211 13.5314 13.9591 13.9993 13.5689 14.0672 13.6535 14.1265 (61)											
Total heat required for water heating calculated for each month											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (62)											
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)											
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (64)											
Heat gains from water heating, kWh/month											
56.4599 49.4786 51.2908 45.0435 43.4632 37.8634 35.4411 40.1645 40.4948 46.7562 50.6126 54.7869 (65)											
Total per year (kWh/year) = Sum(64)m = 1700.7860 (64)											

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W	
North					0.6000	10.6334	0.4400	0.0000	0.7700	2.1616 (74)		
East					3.4900	19.6403	0.4400	0.0000	0.7700	23.2229 (76)		
West					4.5200	19.6403	0.4400	0.0000	0.7700	30.0766 (80)		
Solar gains	55.4611	108.3960	178.7292	261.7034	322.0978	330.4361	314.2892	268.9738	208.1452	128.6366	69.1248	45.6329 (83)
Total gains	671.2757	718.5782	764.0214	809.0031	830.6992	804.9681	769.5132	733.9207	695.5507	654.2574	636.7526	644.8431 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	50.4705	50.5669	50.6617	51.1120	51.1972	51.5973	51.5973	51.6721	51.4424	51.1972	51.0252	50.8467
alpha	4.3647	4.3711	4.3774	4.4075	4.4131	4.4398	4.4398	4.4448	4.4295	4.4131	4.4017	4.3898
util living area	0.9902	0.9855	0.9737	0.9413	0.8661	0.7198	0.5576	0.6017	0.8200	0.9515	0.9839	0.9917 (86)
MIT	19.7221	19.8518	20.0958	20.4259	20.7214	20.9154	20.9788	20.9702	20.8410	20.4701	20.0402	19.6927 (87)
Th 2	19.9908	19.9925	19.9942	20.0022	20.0037	20.0107	20.0107	20.0119	20.0080	20.0037	20.0007	19.9975 (88)
util rest of house	0.9876	0.9817	0.9663	0.9237	0.8243	0.6370	0.4428	0.4873	0.7523	0.9334	0.9789	0.9896 (89)
MIT 2	18.2995	18.4889	18.8424	19.3160	19.7139	19.9463	20.0009	19.9969	19.8701	19.3859	18.7695	18.2615 (90)
Living area fraction	18.6017	18.7783	19.1086	19.5517	19.9279	20.1521	20.2085	20.2036	20.0763	19.6162	19.0394	18.5654 (92)
Temperature adjustment	18.4517	18.6283	18.9586	19.4017	19.7779	20.0021	20.0585	20.0536	19.9263	19.4662	18.8894	18.4154 (93)
adjusted MIT												

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	659.1457	700.1254	730.4205	736.4210	675.5459	512.1544	345.2028	361.4180	518.7328	602.2915	618.3223	634.8722 (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	1468.9073	1422.2510	1288.2864	1076.3659	826.5662	548.4810	351.1484	370.4184	593.3258	907.2265	1210.4019	1464.6097 (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	602.4626	485.2684	415.0522	244.7604	112.3591	0.0000	0.0000	0.0000	0.0000	226.8716	426.2973	617.3247 (98)
Space heating												3130.3964 (98)
Space heating per m2										(98) / (4) =		33.5448 (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													3459.0016 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.4626	485.2684	415.0522	244.7604	112.3591	0.0000	0.0000	0.0000	0.0000	226.8716	426.2973	617.3247	(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)	665.7045	536.2082	458.6212	270.4535	124.1537	0.0000	0.0000	0.0000	0.0000	250.6869	471.0468	682.1267	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)
Efficiency of water heater (217)m	89.7649	89.7157	89.5955	89.3150	88.7298	87.3000	87.3000	87.3000	87.3000	89.2295	89.6215	89.7950	(216)
Fuel for water heating, kWh/month	193.0735	169.3948	176.0763	155.4539	151.2403	134.2869	126.0634	142.3470	143.3625	161.5056	173.6257	187.4023	(217)
Water heating fuel used												1913.8321	(219)
Annual totals kWh/year													
Space heating fuel - main system												3459.0016	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												452.9861	(232)
Total delivered energy for all uses												5900.8197	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3459.0016	3.4800	120.3733 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1913.8321	3.4800	66.6014 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	452.9861	13.1900	59.7489 (250)
Additional standing charges			120.0000 (251)
Total energy cost			376.6160 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.1436 (257)
SAP value	84.0472
SAP rating (Section 12)	84 (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	3459.0016	0.2160	747.1443 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.8321	0.2160	413.3877 (264)
Space and water heating			1160.5321 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total kg/year			1434.5568 (272)
CO2 emissions per m2			15.3700 (273)
EI value			86.1025
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	$3.48 / 0.8875 = 3.921$, stars = 4
Water heating environmental impact	$0.216 / 0.8875 = 0.2434$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
Calculation of EPC Costs, Emissions and Primary Energy 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2854 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.5936		(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss						(33) + (36) =	60.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	102.1576	101.8363	101.8363	101.3837	101.3837	100.8351	100.9664	100.7077	100.8351	101.1016	101.1016	101.5306 (39)
Average = Sum(39)m / 12 =												101.3063 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0947	1.0913	1.0913	1.0864	1.0864	1.0805	1.0819	1.0792	1.0805	1.0834	1.0834	1.0880 (40)
HLP (average)												1.0856 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

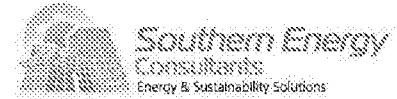
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761 20.8822 21.5485 18.7865 18.0261 15.5552 14.4141 16.5404 16.7380 19.5065 21.2929 23.1227 (46)											
Water storage loss:											
Total storage loss											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (56)											
If cylinder contains dedicated solar storage											
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (57)											
Combi loss 14.1386 12.7594 14.0997 13.6002 14.0211 13.5314 13.9591 13.9993 13.5689 14.0672 13.6535 14.1265 (61)											
Total heat required for water heating calculated for each month											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (62)											
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)											
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h											
173.3123 151.9738 157.7565 138.8437 134.1952 117.2324 110.0534 124.2689 125.1555 144.1106 155.6060 168.2778 (64)											
Heat gains from water heating, kWh/month											
56.4599 49.4786 51.2908 45.0435 43.4632 37.8634 35.4411 40.1645 40.4948 46.7562 50.6126 54.7869 (65)											
Total per year (kWh/year) = Sum(64)m = 1700.7860 (64)											

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102	(73)

6. Solar gains

[Jan]																					
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W								
North	0.6000				11.9814		0.4400		0.0000		0.7700		2.4356 (74)								
East	3.4900				22.3313		0.4400		0.0000		0.7700		26.4048 (76)								
West	4.5200				22.3313		0.4400		0.0000		0.7700		34.1976 (80)								
Solar gains	63.0380	110.8644	180.3284	271.4341	324.8426	356.3636	335.3926	293.9655	227.4225	140.4269	80.4983	51.3588	(83)								
Total gains	678.8526	721.0466	765.6205	818.7338	833.4440	830.8956	790.6166	758.9124	714.8280	666.0477	648.1261	650.5690	(84)								

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.2806	51.4424	51.4424	51.6721	51.6721	51.9532	51.8856	52.0189	51.9532	51.8163	51.8163	51.5973
alpha	4.4187	4.4295	4.4295	4.4448	4.4448	4.4635	4.4590	4.4679	4.4635	4.4544	4.4544	4.4398
util living area	0.9876	0.9825	0.9663	0.9195	0.8051	0.5793	0.3920	0.4193	0.7270	0.9283	0.9778	0.9894 (86)
MIT	19.8550	19.9671	20.2250	20.5520	20.8315	20.9725	20.9963	20.9951	20.9215	20.6004	20.1811	19.8332 (87)
Th 2	20.0052	20.0080	20.0080	20.0119	20.0119	20.0168	20.0156	20.0179	20.0168	20.0144	20.0144	20.0107 (88)
util rest of house	0.9842	0.9777	0.9565	0.8950	0.7462	0.4771	0.2696	0.2934	0.6353	0.9009	0.9706	0.9864 (89)
MIT 2	18.5028	18.6668	19.0375	19.4970	19.8552	20.0017	20.0148	20.0167	19.9611	19.5727	18.9824	18.4752 (90)
Living area fraction	18.7900	18.9430	19.2897	19.7211	20.0626	20.2079	20.2233	20.2245	20.1651	19.7910	19.2370	18.7636 (92)
Temperature adjustment	18.6400	18.7930	19.1397	19.5711	19.9126	20.0579	20.0733	20.0745	20.0151	19.6410	19.0870	-0.1500
adjusted MIT	18.6400	18.7930	19.1397	19.5711	19.9126	20.0579	20.0733	20.0745	20.0151	19.6410	19.0870	18.6136 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9776	0.9695	0.9452	0.8816	0.7395	0.4816	0.2769	0.3008	0.6351	0.8878	0.9613	0.9805 (94)
Useful gains	663.6446	699.0838	723.6468	721.8086	616.3155	400.1921	218.9044	228.3012	454.0133	591.3161	623.0391	637.8961 (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	1383.2158	1343.5234	1195.5253	980.4869	700.8238	409.1744	219.4271	229.0600	485.5295	812.9560	1120.9116	1372.0443 (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	535.3610	433.0634	351.0776	186.2484	62.8742	0.0000	0.0000	0.0000	0.0000	164.9001	358.4682	546.2062 (98)
Space heating												2638.1990 (98)
Space heating per m2												(98) / (4) = 28.2705 (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													2915.1370	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	535.3610	433.0634	351.0776	186.2484	62.8742	0.0000	0.0000	0.0000	0.0000	164.9001	358.4682	546.2062	(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)	591.5591	478.5231	387.9310	205.7993	69.4743	0.0000	0.0000	0.0000	0.0000	182.2100	396.0974	603.5428	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating requirement	173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778	(64)	
Efficiency of water heater (217)m	89.6959	89.6464	89.4831	89.1051	88.2961	87.3000	87.3000	87.3000	87.3000	88.9789	89.5069	89.7254	(216)	
Fuel for water heating, kWh/month	193.2220	169.5258	176.2975	155.8202	151.9831	134.2869	126.0634	142.3470	143.3625	161.9603	173.8481	187.5476	(219)	
Water heating fuel used												1916.2645	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2915.1370	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
Total electricity for the above, kWh/year													75.0000	(231)
Electricity for lighting (calculated in Appendix L)													452.9861	(232)
Total delivered energy for all uses													5359.3875	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2915.1370	3.8700	112.8158 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1916.2645	3.8700	74.1594 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	452.9861	18.9000	85.6144 (250)
Additional standing charges			93.0000 (251)
Total energy cost			379.7646 (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	2915.1370	0.2160	629.6696 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.2645	0.2160	413.9131 (264)
Space and water heating			1043.5827 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total kg/year			1317.6075 (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	2915.1370	1.2200	3556.4671 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1916.2645	1.2200	2337.8426 (264)
Space and water heating			5894.3098 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	452.9861	3.0700	1390.6672 (268)
Primary energy kWh/year			7515.2270 (272)
Primary energy kWh/m2/year			80.5318 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	Recommended
O	Not considered
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U Solar photovoltaic panels	Recommended
A2	Not considered
A3	Not considered
T2	Not considered
W	Not considered
X	Not considered
Y	Not considered
J2	Not considered
Q2	Not considered
Z1	Not considered
Z2	Not considered
Z3	Not considered
Z4	Not considered
Z5	Not considered
V2 Wind turbine	Not applicable
L2	Not considered
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 29	-187 kg (14.2%)
U Solar photovoltaic panels	+ 9.7	-£ 345	-947 kg (83.8%)

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

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

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

Typical heating and lighting costs of this home (per year, Thames Valley):

	Current	Potential	Saving
Electricity	£100	£109	-£9
Mains gas	£280	£242	£38
Space heating	£220	£220	£0
Water heating	£74	£45	£29
Lighting	£86	£86	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£380	£6	£374
Total cost of uses	£380	£6	£374
Delivered energy	57 kWh/m²	28 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	2 kg/m²	12 kg/m²
Primary energy	81 kWh/m²	9 kWh/m²	71 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 0.8500 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.2854 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.5936			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss							(33) + (36) = 60.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	43.5905	43.3926	43.1986	42.2876	42.1171	41.3236	41.3236	41.1767	41.6293	42.1171	42.4620	42.8225 (38)
Heat transfer coeff	103.7975	103.5996	103.4056	102.4946	102.3241	101.5306	101.5306	101.3837	101.8363	102.3241	102.6689	103.0294 (39)
Average = Sum(39)m / 12 =												102.4938 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1123	1.1102	1.1081	1.0983	1.0965	1.0880	1.0880	1.0864	1.0913	1.0965	1.1002	1.1040 (40)
HLP (average)												1.0983 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

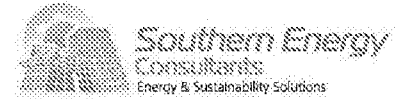
Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-25.0192	-41.7499	-71.1048	-95.2945	-117.7283	-115.7457	-114.2161	-99.7912	-78.1565	-53.3717	-29.6764 (63)
Output from w/h											
148.2931	110.2239	86.6516	43.5492	16.4668	1.4867	0.0000	24.4777	46.9990	90.7389	125.9296	147.3410 (64)
Heat gains from water heating, kWh/month											
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6000	10.6334	0.4400	0.0000	0.7700	2.1616 (74)
East	3.4900	19.6403	0.4400	0.0000	0.7700	23.2229 (76)
West	4.5200	19.6403	0.4400	0.0000	0.7700	30.0766 (80)

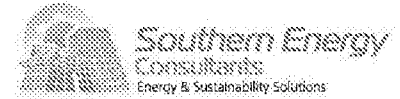
Solar gains	55.4611	108.3960	178.7292	261.7034	322.0978	330.4361	314.2892	268.9738	208.1452	128.6366	69.1248	45.6329 (83)
Total gains	671.2757	718.5782	764.0214	809.0031	830.6992	804.9681	769.5132	733.9207	695.5507	654.2574	636.7526	644.8431 (84)

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	50.4705	50.5669	50.6617	51.1120	51.1972	51.5973	51.5973	51.6721	51.4424	51.1972	51.0252	50.8467
alpha	4.3647	4.3711	4.3774	4.4075	4.4131	4.4398	4.4398	4.4448	4.4295	4.4131	4.4017	4.3898
util living area	0.9902	0.9855	0.9737	0.9413	0.8661	0.7198	0.5576	0.6017	0.8200	0.9515	0.9839	0.9917 (86)
MIT	19.7221	19.8516	20.0958	20.4259	20.7214	20.9154	20.9788	20.9702	20.8410	20.4701	20.0402	19.6927 (87)
Th 2	19.9908	19.9925	19.9942	20.0022	20.0037	20.0107	20.0107	20.0119	20.0080	20.0037	20.0007	19.9975 (88)
util rest of house	0.9876	0.9817	0.9663	0.9237	0.8243	0.6370	0.4428	0.4873	0.7523	0.9334	0.9789	0.9896 (89)
MIT 2	18.2995	18.4889	18.8424	19.3160	19.7139	19.9463	20.0009	19.9969	19.8701	19.3859	18.7695	18.2615 (90)
Living area fraction												
MIT	18.6017	18.7783	19.1086	19.5517	19.9279	20.1521	20.2085	20.2036	20.0763	19.6162	19.0394	18.5654 (92)
Temperature adjustment												
adjusted MIT	18.4517	18.6283	18.9586	19.4017	19.7779	20.0021	20.0585	20.0536	19.9263	19.4662	18.8894	18.4154 (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	0.9819	0.9743	0.9560	0.9103	0.8132	0.6362	0.4486	0.4924	0.7458	0.9206	0.9711	0.9845	(94)
Useful gains	659.1457	700.1254	730.4205	736.4210	675.5459	512.1544	345.2028	361.4180	518.7328	602.2915	618.3223	634.8722	(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													
	1468.9073	1422.2510	1288.2864	1076.3659	826.5662	548.4810	351.1484	370.4184	593.3258	907.2265	1210.4019	1464.6097	(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													
	602.4626	485.2684	415.0522	244.7604	112.3591	0.0000	0.0000	0.0000	0.0000	226.8716	426.2973	617.3247	(98)
Space heating													3130.3964 (98)
Space heating per m2											(98) / (4) =	33.5448	(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													3459.0016 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	602.4626	485.2684	415.0522	244.7604	112.3591	0.0000	0.0000	0.0000	0.0000	226.8716	426.2973	617.3247	(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)	665.7045	536.2082	458.6212	270.4535	124.1537	0.0000	0.0000	0.0000	0.0000	250.6869	471.0468	682.1267	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	148.2931	110.2239	86.6516	43.5492	16.4668	1.4867	0.0000	24.4777	46.9990	90.7389	125.9296	147.3410	(64)
Efficiency of water heater	89.8495	89.8901	89.9307	90.0017	90.0780	87.3000	87.3000	87.3000	87.3000	89.5621	89.7498	89.8653	(217)
Fuel for water heating, kWh/month	165.0462	122.6207	96.3538	48.3871	18.2806	1.7030	0.0000	28.0386	53.8362	101.3140	140.3119	163.9576	(219)
Water heating fuel used												939.8496	(219)
Annual totals kWh/year													
Space heating fuel - main system												3459.0016	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													452.9861 (232)
Energy saving/generation technologies (Appendices M, N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =									-1727.2394			-1727.2394	(233)
Total delivered energy for all uses												3249.5978	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3459.0016	3.4800	120.3733	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	939.8496	3.4800	32.7068	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	452.9861	13.1900	59.7489	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			121.4935	(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] =	0.3689 (257)
SAP value		94.8537
SAP rating (Section 12)		95 (258)
SAP band		A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3459.0016	0.2160	747.1443 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	939.8496	0.2160	203.0075 (264)
Space and water heating			950.1518 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			353.6894 (272)
CO2 emissions per m2			3.7900 (273)
EI value			96.5736
EI rating			97 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	46.6600 (1b)	x 2.3400 (2b)	= 109.1844 (1b) - (3b)
First floor	46.6600 (1c)	x 2.6600 (2c)	= 124.1156 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	93.3200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 233.3000 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2854 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1800	8.3988	75.0000	3499.5000 (28a)
Brick Cavity	96.8000	12.9100	83.8900	0.2500	20.9725	60.0000	5033.4000 (29a)
External Roof 1	46.6600		46.6600	0.1100	5.1326	9.0000	419.9400 (30)
Total net area of external elements Aum (A, m ²)			190.1200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	51.5936			(33)
Party Wall 1			45.2500	0.0000	0.0000	110.0000	4977.5000 (32)
Internal Wall 1			159.3600			9.0000	1434.2400 (32c)
Internal Wall 2			24.2000			75.0000	1815.0000 (32c)
Internal Floor 1			46.6600			18.0000	839.8800 (32d)
Internal Ceiling 1			46.6600			18.0000	839.8800 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e)				18859.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							202.0932 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6134 (36)
Total fabric heat loss			(33) + (36) =				60.2070 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9506	41.6293	41.6293	41.1767	41.1767	40.6281	40.7594	40.5008	40.6281	40.8946	40.8946	41.3236 (38)
Heat transfer coeff	102.1576	101.8363	101.8363	101.3837	101.3837	100.8351	100.9664	100.7077	100.8351	101.1016	101.1016	101.5306 (39)
Average = Sum(39)m / 12 =												101.3063 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.0947	1.0913	1.0913	1.0864	1.0864	1.0805	1.0819	1.0792	1.0805	1.0834	1.0834	1.0880 (40)
HLP (average)												1.0856 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-27.0774	-40.6973	-68.5395	-94.7425	-114.1018	-120.0872	-117.2037	-104.6636	-81.6903	-55.5724	-32.9133
Output from w/h	146.2349	111.2764	89.2170	44.1012	20.0933	0.0000	0.0000	19.6053	43.4651	88.5382	122.6927
Heat gains from water heating, kWh/month	56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126
Solar input (sum of months) = Sum(63)m =											
-879.7230											
Total per year (kWh/year) = Sum(64)m =											
831.0680											
54.7869 (65)											

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	160.1095	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1249	56.9551	46.3190	35.0665	26.2126	22.1298	23.9120	31.0817	41.7179	52.9704	61.8243	65.9071	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	365.7535	369.5489	359.9846	339.6235	313.9213	289.7648	273.6268	269.8314	279.3956	299.7568	325.4590	349.6155	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	53.6794	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	-106.7397	(71)
Water heating gains (Table 5)	75.8870	73.6289	68.9392	62.5604	58.4182	52.5881	47.6359	53.9845	56.2427	62.8444	70.2953	73.6383	(72)
Total internal gains	615.8146	610.1822	585.2922	547.2997	508.6014	474.5320	455.2240	464.9469	487.4055	525.6208	567.6278	599.2102	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.6000	11.9814	0.4400	0.0000	0.7700	2.4356 (74)
East	3.4900	22.3313	0.4400	0.0000	0.7700	26.4048 (76)
West	4.5200	22.3313	0.4400	0.0000	0.7700	34.1976 (80)

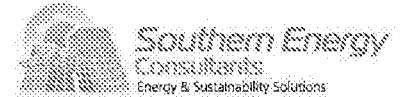
Solar gains	63.0380	110.8644	180.3284	271.4341	324.8426	356.3636	335.3926	293.9655	227.4225	140.4269	80.4983	51.3588 (83)
Total gains	678.8526	721.0466	765.6205	818.7338	833.4440	830.8956	790.6166	758.9124	714.8280	666.0477	648.1261	650.5690 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	51.2806	51.4424	51.4424	51.6721	51.6721	51.9532	51.8856	52.0189	51.9532	51.8163	51.8163	51.5973
alpha	4.4187	4.4295	4.4295	4.4448	4.4448	4.4635	4.4590	4.4679	4.4635	4.4544	4.4544	4.4398
util living area												
	0.9876	0.9825	0.9663	0.9195	0.8051	0.5793	0.3920	0.4193	0.7270	0.9283	0.9778	0.9894 (86)
MIT	19.8550	19.9671	20.2250	20.5520	20.8315	20.9725	20.9963	20.9951	20.9215	20.6004	20.1811	19.8332 (87)
Th 2	20.0052	20.0080	20.0080	20.0119	20.0119	20.0168	20.0156	20.0179	20.0168	20.0144	20.0144	20.0107 (88)
util rest of house												
	0.9842	0.9777	0.9565	0.8950	0.7462	0.4771	0.2696	0.2934	0.6353	0.9009	0.9706	0.9864 (89)
MIT 2	18.5028	18.6668	19.0375	19.4970	19.8552	20.0017	20.0148	20.0167	19.9611	19.5727	18.9824	18.4752 (90)
Living area fraction									fLa = Living area / (4) =			0.2124 (91)
MIT	18.7900	18.9430	19.2897	19.7211	20.0626	20.2079	20.2233	20.2245	20.1651	19.7910	19.2370	18.7636 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.6400	18.7930	19.1397	19.5711	19.9126	20.0579	20.0733	20.0745	20.0151	19.6410	19.0870	18.6136 (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	0.9776	0.9695	0.9452	0.8816	0.7395	0.4816	0.2769	0.3008	0.6351	0.8878	0.9613	0.9805	(94)
Useful gains	663.6446	699.0838	723.6468	721.8086	616.3155	400.1921	218.9044	228.3012	454.0133	591.3161	623.0391	637.8961	(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													
	1383.2158	1343.5234	1195.5253	980.4869	700.8238	409.1744	219.4271	229.0600	485.5295	812.9560	1120.9116	1372.0443	(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													
	535.3610	433.0634	351.0776	186.2484	62.8742	0.0000	0.0000	0.0000	0.0000	164.9001	358.4682	546.2062	(98)
Space heating												2638.1990	(98)
Space heating per m2											(98) / (4) =	28.2705	(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													2915.1370	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	535.3610	433.0634	351.0776	186.2484	62.8742	0.0000	0.0000	0.0000	0.0000	164.9001	358.4682	546.2062	(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)	591.5591	478.5231	387.9310	205.7993	69.4743	0.0000	0.0000	0.0000	0.0000	182.2100	396.0974	603.5428	(211)	
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)	
Water heating														
Water heating requirement	146.2349	111.2764	89.2170	44.1012	20.0933	0.0000	0.0000	19.6053	43.4651	88.5382	122.6927	145.8440	(64)	
Efficiency of water heater	89.7938	89.8269	89.8328	89.8693	89.7037	87.3000	87.3000	87.3000	87.3000	89.3558	89.6619	89.8063	(217)	
Fuel for water heating, kWh/month	162.8563	123.8787	99.3145	49.0725	22.3997	0.0000	0.0000	22.4574	49.7883	99.0850	136.8392	162.3984	(219)	
Water heating fuel used												928.0900	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2915.1370	(211)
Space heating fuel - secondary													0.0000	(215)
Electricity for pumps and fans:														
central heating pump													30.0000	(230c)
main heating flue fan													45.0000	(230e)
pump for solar water heating													50.0000	(230g)
Total electricity for the above, kWh/year													125.0000	(231)
Electricity for lighting (calculated in Appendix L)													452.9861	(232)
Energy saving/generation technologies (Appendices M ,N and Q)														
PV Unit 0 (0.80 * 2.50 * 1140 * 0.80) =									-1824.1596			-1824.1596	(233)	
Total delivered energy for all uses													2597.0534	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2915.1370	3.8700	112.8158	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	928.0900	3.8700	35.9171	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	452.9861	18.9000	85.6144	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			6.2061	(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	2915.1370	0.2160	629.6696	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	928.0900	0.2160	200.4674	(264)
Space and water heating			830.1370	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	452.9861	0.5190	235.0998	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

Regs Region: England

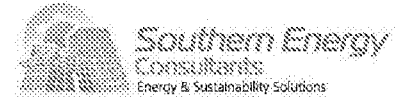
Elmhurst Energy Systems

SAP2012 Calculator (Design

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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 183.3729 (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	2915.1370	1.2200	3556.4671 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	928.0900	1.2200	1132.2698 (264)
Space and water heating			4688.7369 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	452.9861	3.0700	1390.6672 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			862.9840 (272)
Primary energy kWh/m2/year			9.2476 (273)

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

Overheating Calculation Input Data

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

Overheating Calculation

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

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
East	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	0.6000	81.1852	0.4400	0.0000	0.9000	19.2896
East	3.4900	117.5071	0.4400	0.0000	0.9000	162.3995
West	4.5200	117.5071	0.4400	0.0000	0.9000	210.3283

total: 392.0173

	Jun	Jul	Aug	
Solar gains	417	392	344	(P4)
Internal gains	472	452	462	
Total summer gains	888	844	806	(P5)

Summer gain/loss ratio	2.41	2.29	2.19	(P6)
Summer external temperature	16.00	17.90	17.60	
Thermal mass temperature increment (TMP = 202.1)	0.59	0.59	0.59	
Threshold temperature	19.00	20.78	20.57	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight