

FULL SAP CALCULATION PRINTOUT

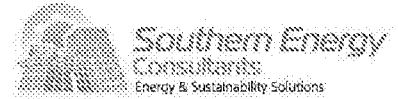
Calculation Type: New Build (As Designed)



Property Reference	SECANG008b		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	End Bri Re Ga Ea		
Property	WP3520A+, Plot 17				
SAP Rating	84 B	DER	17.49	TSL	18.06
Environmental	36 B	% DER<TER	3.15		
CO ₂ Emissions (t/year)	1.33	DPEE	48.64	TPEE	51.88
General Requirements Compliance	Pass	% DPEE<TPEE	6.25		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

End-Terrace 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) 18.06 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.49 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)48.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

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

10 Key Features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1900	8.8654	75.0000	3499.5000 (28a)
Brick/Render Cavity	101.9500	12.9100	89.0400	0.2500	22.2600	60.0000	5342.4000 (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)			195.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.3477			(33)
Party Wall 1			40.3000	0.0000	0.0000	110.0000	4433.0000 (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) =	18623.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							199.5697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1002 (36)
Total fabric heat loss						(33) + (36) =	62.4479 (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	106.0384	105.8405	105.6465	104.7355	104.5650	103.7715	103.7715	103.6246	104.0772	104.5650	104.9099	105.2704 (39)
Average = Sum(39)m / 12 =												104.7347 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1363	1.1342	1.1321	1.1223	1.1205	1.1120	1.1120	1.1104	1.1153	1.1205	1.1242	1.1281 (40)
HLP (average)												1.1223 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

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

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

6. Solar gains

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

7. Mean internal temperature (heating season)

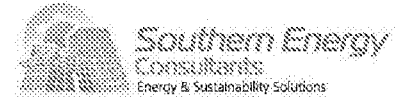
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.7869	48.8782	48.9679	49.3938	49.4744	49.8527	49.8527	49.9234	49.7063	49.4744	49.3117	49.1429
alpha	4.2525	4.2585	4.2645	4.2929	4.2983	4.3235	4.3235	4.3282	4.3138	4.2983	4.2874	4.2762
util living area	0.9973	0.9952	0.9897	0.9725	0.9254	0.8157	0.6661	0.7159	0.9039	0.9817	0.9953	0.9978 (86)
MIT	19.4428	19.5863	19.8561	20.2267	20.5815	20.8465	20.9535	20.9357	20.7296	20.2709	19.7916	19.4153 (87)
Th 2	19.9713	19.9730	19.9747	19.9826	19.9841	19.9910	19.9910	19.9923	19.9884	19.9841	19.9811	19.9780 (88)
util rest of house	0.9965	0.9939	0.9865	0.9630	0.8967	0.7409	0.5395	0.5950	0.8551	0.9738	0.9936	0.9972 (89)
MIT 2	17.8818	18.0924	18.4867	19.0273	19.5244	19.8642	19.9676	19.9564	19.7314	19.0968	18.3985	17.8461 (90)
Living area fraction	18.2133	18.4097	18.7775	19.2820	19.7489	20.0728	20.1770	20.1644	19.9434	19.3462	18.6944	18.1794 (91)
MIT	18.0633	18.2597	18.6275	19.1320	19.5989	19.9228	20.0270	20.0144	19.7934	19.1962	18.5444	18.0294 (92)
Temperature adjustment												-0.1500
adjusted MIT												18.0294 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9943	0.9904	0.9803	0.9522	0.8829	0.7349	0.5445	0.5980	0.8431	0.9647	0.9901	0.9953	(94)
Useful gains	472.6953	524.7681	574.6998	612.2384	596.4085	483.7698	341.7271	353.7041	460.7931	474.0795	452.3126	450.2060	(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	1459.4386	1413.9961	1281.2285	1071.6572	825.9516	552.3557	355.6214	374.5402	592.5523	898.8610	1200.6289	1455.8239	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	734.1370	597.5613	525.6574	330.7815	170.7801	0.0000	0.0000	0.0000	0.0000	316.0375	538.7877	748.1798	(98)
Space heating												3961.9222	(98)
Space heating per m2												(98) / (4) =	42.4552 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													4377.8145	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	734.1370	597.5613	525.6574	330.7815	170.7801	0.0000	0.0000	0.0000	0.0000	316.0375	538.7877	748.1798	(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)	811.2011	660.2887	580.8369	365.5044	188.7073	0.0000	0.0000	0.0000	0.0000	349.2127	595.3455	826.7180	(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	89.8708	89.8324	89.7407	89.5298	89.0635	87.3000	87.3000	87.3000	87.3000	89.4729	89.7627	89.8950	(216)	
Fuel for water heating, kWh/month	192.8460	169.1749	175.7915	155.0810	150.6736	134.2869	126.0634	142.3470	143.3625	161.0662	173.3527	187.1938	(219)	
Water heating fuel used												1911.2394	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4377.8145	(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													6817.0400	(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	4377.8145	0.2160	945.6079	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1911.2394	0.2160	412.8277	(264)
Space and water heating			1358.4357	(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			1632.4604	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.4900	(273)

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

DER		17.4900	ZC1
Total Floor Area		93.3200	
Assumed number of occupants		2.6685	
CO2 emission factor in Table 12 for electricity displaced from grid		0.5190	
CO2 emissions from appliances, equation (L14)		15.5609	ZC2
CO2 emissions from cooking, equation (L16)		1.9615	ZC3
Total CO2 emissions		35.0124	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		35.0124	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			8.6100	1.3258	11.4148		(27)
Heat Loss Floor 1			46.6600	0.1300	6.0658		(28a)
Brick/Pender Cavity	101.9500	12.9100	89.0400	0.1800	16.0272		(29a)
External Roof 1	46.6600		46.6600	0.1300	6.0658		(30)
Total net area of external elements Aum(A, m ²)			195.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3036		(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)							10.2261 (36)
Total fabric heat loss						(33) + (36) =	54.5297 (37)
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)							
(38)m	44.9748	44.7232	44.4765	43.3180	43.1012	42.0922	42.0922
Heat transfer coeff	99.5045	99.2528	99.0062	97.8476	97.6309	96.6218	96.6218
Average = Sum(39)m / 12 =							
HLP	1.0663	1.0636	1.0609	1.0485	1.0462	1.0354	1.0354
HLP (average)							
Days in month	31	28	31	30	31	30	31

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	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		
East				3.4900	19.6403	0.6300	0.7000	0.7700		20.9481 (76)		
South				0.6000	46.7521	0.6300	0.7000	0.7700		8.5728 (78)		
West				4.5200	19.6403	0.6300	0.7000	0.7700		27.1305 (80)		
Solar gains	56.6514	108.0920	172.7747	246.1114	297.9101	303.6725	289.6158	250.9970	198.8261	126.7441	70.1101	46.9452 (83)
Total gains	481.6430	530.5045	579.7633	627.9254	654.1624	635.6214	606.5208	575.2304	536.6412	489.9566	461.6024	459.5926 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)														
tau	65.1283	65.2934	65.4561	66.2311	66.3781	67.0713	67.0713	67.2013	66.8026	66.3781	66.0813	65.7739		
alpha	5.3419	5.3529	5.3637	5.4154	5.4252	5.4714	5.4714	5.4801	5.4535	5.4252	5.4054	5.3849		
util living area	0.9990	0.9982	0.9954	0.9846	0.9463	0.8336	0.6676	0.7190	0.9218	0.9900	0.9981	0.9993	(86)	
MIT	19.7935	19.9075	20.1218	20.4200	20.7036	20.9090	20.9792	20.9691	20.8206	20.4560	20.0751	19.7753	(87)	
Th 2	20.0285	20.0307	20.0329	20.0431	20.0450	20.0540	20.0540	20.0556	20.0505	20.0450	20.0411	20.0371	(88)	
util rest of house	0.9987	0.9975	0.9936	0.9780	0.9208	0.7568	0.5406	0.5959	0.8741	0.9846	0.9973	0.9990	(89)	
MIT 2	18.4059	18.5742	18.8885	19.3279	19.7259	19.9848	20.0452	20.0409	19.8878	19.3844	18.8271	18.3855	(90)	
Living area fraction	18.7006	18.8574	19.1504	19.5599	19.9335	20.1811	20.2435	20.2381	20.0859	19.6120	19.0922	18.6807	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.7006	18.8574	19.1504	19.5599	19.9335	20.1811	20.2435	20.2381	20.0859	19.6120	19.0922	18.6807	(93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9980	0.9964	0.9913	0.9735	0.9170	0.7685	0.5676	0.6217	0.8763	0.9811	0.9961	0.9985	(94)
Useful gains	480.6970	528.5788	574.7249	611.2787	599.8934	488.4790	344.2867	357.6297	470.2842	480.6765	459.8101	458.8934	(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	1432.9232	1385.3098	1252.4709	1043.0431	803.8480	539.2525	352.0464	370.1257	580.6966	879.8463	1176.0634	1426.7509	(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	708.4563	575.7232	504.2430	310.8703	151.7423	0.0000	0.0000	0.0000	0.0000	296.9823	515.7024	720.0860	(98)
Space heating												3783.8058	(98)
Space heating per m ²												40.5466	(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													4051.1839 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	708.4563	575.7232	504.2430	310.8703	151.7423	0.0000	0.0000	0.0000	0.0000	296.9823	515.7024	720.0860	(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)	758.5185	616.4060	539.8747	332.8376	162.4649	0.0000	0.0000	0.0000	0.0000	317.9682	552.1439	770.9700	(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	87.8717	87.7143	87.3434	86.5180	84.8123	80.3000	80.3000	80.3000	80.3000	86.2933	87.4250	87.9476	(217)
Fuel for water heating, kWh/month	239.1357	211.1875	222.5414	199.2662	196.8048	183.0748	175.3996	195.5295	197.6889	209.4739	218.7790	233.2185	(219)
Water heating fuel used												2482.0998	(219)
Annual totals kWh/year													
Space heating fuel - main system												4051.1839	(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												7061.2698	(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	4051.1839	0.2160	875.0557 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2482.0998	0.2160	536.1336 (264)
Space and water heating			1411.1893 (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			1685.2140 (272)
Emissions per m2 for space and water heating			15.1220 (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) = (15.1220 * 1.00) + 2.5193 + 0.4171, rounded to 2 d.p.			18.0600 (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)
Air changes per hour					
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	0.1900	8.8654	75.0000	3499.5000 (28a)
Brick/Render Cavity	101.9500	12.9100	89.0400	0.2500	22.2600	60.0000	5342.4000 (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)			195.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.3477			(33)
Party Wall 1			40.3000	0.0000	0.0000	110.0000	4433.0000 (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) =	18203.9000			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							195.0697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1002 (36)
Total fabric heat loss			(33) + (36) =	62.4479			(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	107.4227	107.1711	106.9244	105.7659	105.5491	104.5401	104.5401	104.3532	104.9287	105.5491	105.9876	106.4460 (39)
Average = Sum(39)m / 12 =												105.7648 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1511	1.1484	1.1458	1.1334	1.1310	1.1202	1.1202	1.1182	1.1244	1.1310	1.1357	1.1407 (40)
HLP (average)												1.1334 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W				
East				3.4900	19.6403	0.4400	0.0000	0.7700	23.2229 (76)				
South				0.6000	46.7521	0.4400	0.0000	0.7700	9.5038 (78)				
West				4.5200	19.6403	0.4400	0.0000	0.7700	30.0766 (80)				
Solar gains	62.8033	119.8299	191.5365	272.8370	330.2606	336.6488	321.0656	278.2531	220.4170	140.5074	77.7234	52.0430	(83)
Total gains	441.9984	497.2594	555.3122	614.4030	648.4242	633.2767	604.4340	565.9953	520.2601	462.7027	425.4337	419.7040	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.0724	47.1829	47.2917	47.8097	47.9079	48.3703	48.3703	48.4570	48.1912	47.9079	47.7097	47.5042	
alpha	4.1382	4.1455	4.1528	4.1873	4.1939	4.2247	4.2247	4.2305	4.2127	4.1939	4.1806	4.1669	
util living area	0.9977	0.9959	0.9909	0.9754	0.9325	0.8301	0.6855	0.7370	0.9149	0.9844	0.9960	0.9982	(86)
MIT	19.3526	19.5011	19.7808	20.1682	20.5390	20.8243	20.9441	20.9229	20.6962	20.2145	19.7178	19.3288	(87)
Th 2	19.9593	19.9615	19.9636	19.9737	19.9756	19.9843	19.9843	19.9860	19.9810	19.9756	19.9717	19.9678	(88)
util rest of house	0.9971	0.9947	0.9882	0.9669	0.9062	0.7582	0.5584	0.6172	0.8703	0.9776	0.9947	0.9977	(89)
MIT 2	18.4477	18.5975	18.8776	19.2682	19.6259	19.8829	19.9644	19.9555	19.7797	19.3185	18.8220	18.4304	(90)
Living area fraction	18.6398	18.7894	19.0694	19.4593	19.8198	20.0828	20.1725	20.1609	19.9743	19.5088	19.0122	18.6212	(91)
MIT	18.6398	18.7894	19.0694	19.4593	19.8198	20.0828	20.1725	20.1609	19.9743	19.5088	19.0122	18.6212	(92)
Temperature adjustment	adjusted MIT	18.6398	18.7894	19.0694	19.4593	19.8198	20.0828	20.1725	20.1609	19.9743	19.5088	19.0122	18.6212 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	440.1975	493.7312	546.9260	590.6987	584.3904	485.2681	353.1580	362.4806	452.5689	450.3837	422.4352	418.3300	(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	1540.4248	1488.5444	1343.9779	1116.8158	857.0413	573.1773	373.4669	392.4644	616.3868	940.3151	1262.5492	1535.0777	(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	818.5691	668.5144	593.0066	378.8043	202.8522	0.0000	0.0000	0.0000	0.0000	364.5089	604.8821	830.8603	(98)
Space heating													4461.9980 (98)
Space heating per m2													(98) / (4) = 47.8140 (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	982.6767	773.5966	793.0844	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	0.7421	0.8254	0.7938	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	729.2572	638.5571	629.5384	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	843.0357	807.3059	764.6884	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	81.9205	125.5491	100.5516	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												308.0211 (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	20.4801	31.3873	25.1379	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												77.0053 (107)
Space cooling per m2												0.8252 (108)
Energy for space heating												47.8140 (99)
Energy for space cooling												0.8252 (108)
Total												48.6391 (109)
Dwelling Fabric Energy Efficiency (DFEE)												48.6 (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 m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	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/Render Cavity	101.9500	12.9100	89.0400	0.1800	16.0272			(29a)					
External Roof 1	46.6600		46.6600	0.1300	6.0658			(30)					
Total net area of external elements Aum(A, m2)			195.2700					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	44.3036			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.2261 (36)					
Total fabric heat loss						(33) + (36) =		54.5297 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 44.9748	Feb 44.7232	Mar 44.4765	Apr 43.3180	May 43.1012	Jun 42.0922	Jul 42.0922	Aug 41.9053	Sep 42.4808	Oct 43.1012	Nov 43.5397	Dec 43.9981	(38)
Heat transfer coeff	99.5045	99.2528	99.0062	97.8476	97.6309	96.6218	96.6218	96.4350	97.0105	97.6309	98.0694	98.5278	(39)
Average = Sum(39)m / 12 =												97.8466	(39)
HLP	Jan 1.0663	Feb 1.0636	Mar 1.0609	Apr 1.0485	May 1.0462	Jun 1.0354	Jul 1.0354	Aug 1.0334	Sep 1.0395	Oct 1.0462	Nov 1.0509	Dec 1.0558	(40)
HLP (average)												1.0485	(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)
Daily hot water use	107.3343	103.4313	99.5282	95.6251	91.7221	87.8190	87.8190	91.7221	95.6251	99.5282	103.4313	107.3343 (44)
Energy conte	159.1737	139.2144	143.6568	125.2434	120.1741	103.7011	96.0943	110.2696	111.5866	130.0434	141.9525	154.1513 (45)
Energy content (annual)												Total = Sum(45)m = 1535.2611 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

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

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

6. Solar gains

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

Solar gains	56.6514	108.0920	172.7747	246.1114	297.9101	303.6725	289.6158	250.9970	198.8261	126.7441	70.1101	46.9452 (83)
Total gains	435.8465	485.5216	536.5504	587.6774	616.0737	600.3004	572.9842	538.7391	498.6693	448.9394	417.8204	414.6062 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	65.1283	65.2934	65.4561	66.2311	66.3781	67.0713	67.0713	67.2013	66.8026	66.3781	66.0813	65.7739	
alpha	5.3419	5.3529	5.3637	5.4154	5.4252	5.4714	5.4714	5.4801	5.4535	5.4252	5.4054	5.3849	
util living area	0.9994	0.9988	0.9968	0.9885	0.9573	0.8577	0.6982	0.7534	0.9398	0.9933	0.9988	0.9996 (86)	
MIT	19.7469	19.8620	20.0785	20.3817	20.6736	20.8936	20.9742	20.9612	20.7938	20.4159	20.0306	19.7294 (87)	
Th 2	20.0285	20.0307	20.0329	20.0431	20.0450	20.0540	20.0540	20.0556	20.0505	20.0450	20.0411	20.0371 (88)	
util rest of house	0.9992	0.9984	0.9956	0.9835	0.9358	0.7856	0.5694	0.6307	0.8997	0.9896	0.9983	0.9994 (89)	
MIT 2	18.8741	18.9908	19.2087	19.5177	19.8007	19.9970	20.0463	20.0425	19.9184	19.5548	19.1679	18.8636 (90)	
Living area fraction										fLA = Living area / (4) =		0.2124 (91)	
MIT	19.0595	19.1758	19.3934	19.7012	19.9861	20.1874	20.2434	20.2376	20.1044	19.7377	19.3512	19.0475 (92)	
Temperature adjustment												0.0000	
adjusted MIT	19.0595	19.1758	19.3934	19.7012	19.9861	20.1874	20.2434	20.2376	20.1044	19.7377	19.3512	19.0475 (93)	

8. Space heating requirement

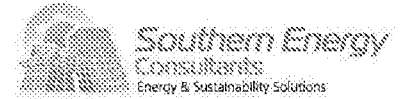
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	435.3805	484.4872	533.5613	576.5512	575.5140	478.6436	342.1625	353.8596	450.0921	443.4987	416.9161	414.2717 (95)	
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)	
Heat loss rate W	1468.6345	1416.9160	1276.5290	1056.8760	808.9762	539.8690	352.0288	370.0819	582.4854	892.1221	1201.4637	1462.8915 (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	768.7410	626.5922	552.7680	345.8338	173.6959	0.0000	0.0000	0.0000	0.0000	333.7758	564.8743	780.1731 (98)	
Space heating												4146.4540 (98)	
Space heating per m2										(98) / (4) =		44.4326 (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	908.2453	715.0017	732.9059	0.0000	0.0000	0.0000	0.0000 (100)	
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7900	0.8753	0.8456	0.0000	0.0000	0.0000	0.0000 (101)	
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	717.4813	625.8176	619.7728	0.0000	0.0000	0.0000	0.0000 (102)	
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	804.4920	770.5463	732.8305	0.0000	0.0000	0.0000	0.0000 (103)	
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)	
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	62.6477	107.6782	84.1150	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												254.4408 (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	15.6619	26.9195	21.0287	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												63.6102 (107)
Space cooling per m2												0.6816 (108)
Energy for space heating												44.4326 (99)
Energy for space cooling												0.6816 (108)
Total												45.1143 (109)
Target Fabric Energy Efficiency (TFEE)												51.9 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
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	0.1900	8.8654	75.0000	3499.5000 (28a)
Brick/Render Cavity	101.9500	12.9100	89.0400	0.2500	22.2600	60.0000	5342.4000 (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)			195.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.3477			(33)
Party Wall 1			40.3000	0.0000	0.0000	110.0000	4433.0000 (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) =	18623.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							199.5697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1002 (36)
Total fabric heat loss						(33) + (36) =	62.4479 (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	104.3985	104.0772	104.0772	103.6246	103.6246	103.0760	103.2073	102.9487	103.0760	103.3425	103.3425	103.7715 (39)
Average = Sum(39)m / 12 =												103.5472 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1187	1.1153	1.1153	1.1104	1.1104	1.1045	1.1060	1.1032	1.1045	1.1074	1.1074	1.1120 (40)
HLP (average)												1.1096 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

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

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

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
East				3.4900	22.3313	0.4400	0.0000	0.7700	26.4048 (76)			
South				0.6000	50.9848	0.4400	0.0000	0.7700	10.3642 (78)			
West				4.5200	22.3313	0.4400	0.0000	0.7700	34.1976 (80)			
Solar gains	70.9667	121.8718	192.2991	281.8874	332.0936	362.1527	341.6985	303.0514	239.7410	152.5581	89.9874	58.2298 (83)
Total gains	686.7813	732.0540	777.5913	829.1871	840.6950	836.6847	796.9225	767.9983	727.1465	678.1789	657.6152	657.4400 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	49.5533	49.7063	49.7063	49.9234	49.9234	50.1891	50.1252	50.2511	50.1891	50.0597	50.0597	49.8527
alpha	4.3036	4.3138	4.3138	4.3282	4.3282	4.3459	4.3417	4.3501	4.3459	4.3373	4.3373	4.3235
util living area	0.9867	0.9812	0.9645	0.9180	0.8066	0.5848	0.3969	0.4227	0.7260	0.9255	0.9764	0.9887 (86)
MIT	19.8159	19.9330	20.1972	20.5301	20.8178	20.9685	20.9956	20.9942	20.9154	20.5846	20.1525	19.7928 (87)
Th 2	19.9856	19.9884	19.9884	19.9923	19.9923	19.9971	19.9960	19.9982	19.9971	19.9948	19.9948	19.9910 (88)
util rest of house	0.9832	0.9761	0.9543	0.8931	0.7475	0.4807	0.2708	0.2936	0.6334	0.8974	0.9689	0.9856 (89)
MIT 2	18.4339	18.6050	18.9846	19.4524	19.8223	19.9797	19.9950	19.9968	19.9370	19.5365	18.9286	18.4044 (90)
Living area fraction	fLA = Living area / (4) = 0.2124 (91)											
MIT	18.7274	18.8871	19.2421	19.6813	20.0337	20.1897	20.2075	20.2087	20.1448	19.7591	19.1885	18.6993 (92)
Temperature adjustment												
adjusted MIT	18.5774	18.7371	19.0921	19.5313	19.8837	20.0397	20.0575	20.0587	19.9948	19.6091	19.0385	18.5493 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9761	0.9674	0.9424	0.8791	0.7403	0.4853	0.2786	0.3016	0.6331	0.8837	0.9590	0.9792 (94)
Useful gains	670.3640	708.2175	732.7757	728.9600	622.3309	406.0688	222.0376	231.6292	460.3730	599.3217	630.6452	643.7696 (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	1407.0242	1367.2679	1216.8845	998.0383	713.3209	416.3958	222.6709	232.5274	494.2324	827.6810	1140.7456	1395.6517 (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	548.0752	442.8819	360.1770	193.7363	67.6966	0.0000	0.0000	0.0000	0.0000	169.8993	367.2723	559.4003 (98)
Space heating	2709.1388 (98)											
RHI space heating demand	2709 (98)											

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1900	8.8654	75.0000	3499.5000 (28a)
Brick/Render Cavity	101.9500	12.9100	89.0400	0.2500	22.2600	60.0000	5342.4000 (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)			195.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		53.3477		(33)
Party Wall 1			40.3000	0.0000	0.0000	110.0000	4433.0000 (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) =	18623.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							199.5697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1002 (36)
Total fabric heat loss						(33) + (36) =	62.4479 (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	106.0384	105.8405	105.6465	104.7355	104.5650	103.7715	103.7715	103.6246	104.0772	104.5650	104.9099	105.2704 (39)
Average = Sum(39)m / 12 =												104.7347 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1363	1.1342	1.1321	1.1223	1.1205	1.1120	1.1120	1.1104	1.1153	1.1205	1.1242	1.1281 (40)
HLP (average)												1.1223 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

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

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

6. Solar gains

[Jan]												
			Area m2			Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W
East			3.4900			19.6403	0.4400		0.0000		0.7700	23.2229 (76)
South			0.6000			46.7521	0.4400		0.0000		0.7700	9.5038 (78)
West			4.5200			19.6403	0.4400		0.0000		0.7700	30.0766 (80)
Solar gains	62.8033	119.8299	191.5365	272.8370	330.2606	336.6488	321.0656	278.2531	220.4170	140.5074	77.7234	52.0430 (83)
Total gains	678.6179	730.0120	776.8287	820.1367	838.8620	811.1808	776.2896	743.2001	707.8225	666.1282	645.3512	651.2532 (84)

7. Mean internal temperature (heating season)

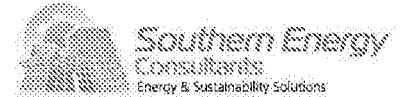
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.7869	48.8782	48.9679	49.3938	49.4744	49.8527	49.8527	49.9234	49.7063	49.4744	49.3117	49.1429
alpha	4.2525	4.2585	4.2645	4.2929	4.2983	4.3235	4.3235	4.3282	4.3138	4.2983	4.2874	4.2762
util living area	0.9895	0.9844	0.9720	0.9395	0.8659	0.7233	0.5622	0.6043	0.8176	0.9491	0.9829	0.9911 (86)
MIT	19.6798	19.8160	20.0663	20.4016	20.7035	20.9066	20.9757	20.9667	20.8318	20.4514	20.0079	19.6489 (87)
Th 2	19.9713	19.9730	19.9747	19.9826	19.9841	19.9910	19.9910	19.9923	19.9884	19.9841	19.9811	19.9780 (88)
util rest of house	0.9868	0.9802	0.9642	0.9214	0.8240	0.6398	0.4451	0.4880	0.7492	0.9303	0.9776	0.9888 (89)
MIT 2	18.2263	18.4249	18.7872	19.2681	19.6753	19.9196	19.9798	19.9754	19.8425	19.3460	18.7106	18.1860 (90)
Living area fraction	18.5350	18.7204	19.0589	19.5088	19.8937	20.1292	20.1913	20.1860	20.0526	19.5808	18.9861	18.4967 (92)
MIT	18.3850	18.5704	18.9089	19.3588	19.7437	19.9792	20.0413	20.0360	19.9026	19.4308	18.8361	18.3467 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9806	0.9723	0.9533	0.9075	0.8123	0.6387	0.4512	0.4934	0.7424	0.9168	0.9692	0.9834 (94)
Useful gains	665.4776	709.8203	740.5408	744.2343	681.4360	518.1391	350.2806	366.6856	525.4817	610.7091	625.4464	640.4508 (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	1493.5487	1446.8821	1310.9533	1095.4087	841.0892	558.2081	357.1070	376.7740	603.9196	923.3891	1231.2321	1489.2318 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh	616.0849	495.3056	424.3869	252.8456	118.7820	0.0000	0.0000	0.0000	0.0000	232.6340	436.1657	631.4931 (98)
Space heating												3207.6976 (98)
Space heating per m2												(98) / (4) = 34.3731 (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													3544.4172 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	616.0849	495.3056	424.3869	252.8456	118.7820	0.0000	0.0000	0.0000	0.0000	232.6340	436.1657	631.4931	(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)	680.7568	547.2990	468.9358	279.3874	131.2508	0.0000	0.0000	0.0000	0.0000	257.0541	481.9510	697.7824	(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	89.7775	89.7278	89.6099	89.3392	88.7739	87.3000	87.3000	87.3000	87.3000	89.2486	89.6360	89.8074	(217)
Fuel for water heating, kWh/month	193.0465	169.3720	176.0481	155.4118	151.1652	134.2869	126.0634	142.3470	143.3625	161.4709	173.5976	187.3764	(219)
Water heating fuel used												1913.5483	(219)
Annual totals kWh/year													
Space heating fuel - main system												3544.4172	(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												5985.9516	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3544.4172	3.4800	123.3457 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1913.5483	3.4800	66.5915 (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			379.5786 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1526 (257)
SAP value	83.9217	
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	3544.4172	0.2160	765.5941 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.5483	0.2160	413.3264 (264)
Space and water heating			1178.9206 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total kg/year			1452.9453 (272)
CO2 emissions per m2			15.5700 (273)
EI value			85.9243
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	$3.48 / 0.8876 = 3.921$, stars = 4
Water heating environmental impact	$0.216 / 0.8876 = 0.2434$, stars = 4

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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	0.1900	8.8654	75.0000	3499.5000 (28a)
Brick/Render Cavity	101.9500	12.9100	89.0400	0.2500	22.2600	60.0000	5342.4000 (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)			195.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.3477			(33)
Party Wall 1			40.3000	0.0000	0.0000	110.0000	4433.0000 (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) =	18623.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							199.5697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1002 (36)
Total fabric heat loss						(33) + (36) =	62.4479 (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	104.3985	104.0772	104.0772	103.6246	103.6246	103.0760	103.2073	102.9487	103.0760	103.3425	103.3425	103.7715 (39)
Average = Sum(39)m / 12 =												103.5472 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1187	1.1153	1.1153	1.1104	1.1104	1.1045	1.1060	1.1032	1.1045	1.1074	1.1074	1.1120 (40)
HLP (average)												1.1096 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

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

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

6. Solar gains

[Jan]												Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d		Gains W		
East												3.4900	22.3313		0.4400	0.0000		0.7700		26.4048 (76)		
South												0.6000	50.9848		0.4400	0.0000		0.7700		10.3642 (78)		
West												4.5200	22.3313		0.4400	0.0000		0.7700		34.1976 (80)		
Solar gains	70.9667	121.8718	192.2991	281.8874	332.0936	362.1527	341.6985	303.0514	239.7410	152.5581	89.9874	58.2298	(83)									
Total gains	686.7813	732.0540	777.5913	829.1871	840.6950	836.6847	796.9225	767.9983	727.1465	678.1789	657.6152	657.4400	(84)									

7. Mean internal temperature (heating season)

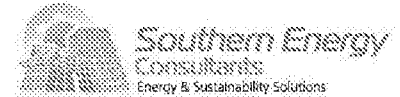
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.5533	49.7063	49.7063	49.9234	49.9234	50.1891	50.1252	50.2511	50.1891	50.0597	50.0597	49.8527
alpha	4.3036	4.3138	4.3138	4.3282	4.3282	4.3459	4.3417	4.3501	4.3459	4.3373	4.3373	4.3235
util living area	0.9867	0.9812	0.9645	0.9180	0.8066	0.5848	0.3969	0.4227	0.7260	0.9255	0.9764	0.9887 (86)
MIT	19.8159	19.9330	20.1972	20.5301	20.8178	20.9685	20.9956	20.9942	20.9154	20.5846	20.1525	19.7928 (87)
Th 2	19.9856	19.9884	19.9884	19.9923	19.9923	19.9971	19.9960	19.9982	19.9971	19.9948	19.9948	19.9910 (88)
util rest of house	0.9832	0.9761	0.9543	0.8931	0.7475	0.4807	0.2708	0.2936	0.6334	0.8974	0.9689	0.9856 (89)
MIT 2	18.4339	18.6050	18.9846	19.4524	19.8223	19.9797	19.9950	19.9968	19.9370	19.5365	18.9286	18.4044 (90)
Living area fraction	18.7274	18.8871	19.2421	19.6813	20.0337	20.1897	20.2075	20.2087	20.1448	19.7591	19.1885	18.6993 (92)
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	1407.0242	1367.2679	1216.8845	998.0383	713.3209	416.3958	222.6709	232.5274	494.2324	827.6810	1140.7456	1395.6517 (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	548.0752	442.8819	360.1770	193.7363	67.6966	0.0000	0.0000	0.0000	0.0000	169.8993	367.2723	559.4003 (98)
Space heating												2709.1388 (98)
Space heating per m2												(98) / (4) = 29.0306 (99)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9761	0.9674	0.9424	0.8791	0.7403	0.4853	0.2786	0.3016	0.6331	0.8837	0.9590	0.9792 (94)
Ext temp.	670.3640	708.2175	732.7757	728.9600	622.3309	406.0688	222.0376	231.6292	460.3730	599.3217	630.6452	643.7696 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1407.0242	1367.2679	1216.8845	998.0383	713.3209	416.3958	222.6709	232.5274	494.2324	827.6810	1140.7456	1395.6517 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	548.0752	442.8819	360.1770	193.7363	67.6966	0.0000	0.0000	0.0000	0.0000	169.8993	367.2723	559.4003 (98)
Space heating per m2												2709.1388 (98)
												(98) / (4) = 29.0306 (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													2993.5236	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	548.0752	442.8819	360.1770	193.7363	67.6966	0.0000	0.0000	0.0000	0.0000	169.8993	367.2723	559.4003	(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)	605.6080	489.3722	397.9856	214.0733	74.8028	0.0000	0.0000	0.0000	0.0000	187.7340	405.8257	618.1219	(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	89.7100	89.6604	89.5007	89.1360	88.3475	87.3000	87.3000	87.3000	87.3000	89.0028	89.5234	89.7393	(216)	
Fuel for water heating, kWh/month	193.1918	169.4994	176.2627	155.7661	151.8947	134.2869	126.0634	142.3470	143.3625	161.9170	173.8159	187.5185	(219)	
Water heating fuel used												1915.9260	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2993.5236	(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													5437.4356	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2993.5236	3.8700	115.8494 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1915.9260	3.8700	74.1463 (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			382.7851 (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	2993.5236	0.2160	646.6011 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1915.9260	0.2160	413.8400 (264)
Space and water heating			1060.4411 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	452.9861	0.5190	235.0998 (268)
Total kg/year			1334.4659 (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	2993.5236	1.2200	3652.0988 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1915.9260	1.2200	2337.4297 (264)
Space and water heating			5989.5284 (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			7610.4456 (272)
Primary energy kWh/m2/year			81.5521 (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 (14.0%)
U Solar photovoltaic panels	+ 9.7	-£ 345	-947 kg (82.5%)

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 96
Total Savings	£374	12.15 kg/m²	

Potential energy efficiency rating: A 95
Potential environmental impact rating: A 96

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	£283	£245	£38
Space heating	£223	£223	£0
Water heating	£74	£45	£29
Lighting	£86	£86	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£383	£9	£374
Total cost of uses	£383	£9	£374
Delivered energy	58 kWh/m²	29 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	82 kWh/m²	10 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	0.1900	8.8654	75.0000	3499.5000 (28a)
Brick/Render Cavity	101.9500	12.9100	89.0400	0.2500	22.2600	60.0000	5342.4000 (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)			195.2700				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	53.3477			(33)
Party Wall 1			40.3000	0.0000	0.0000	110.0000	4433.0000 (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) = 18623.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							199.5697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1002 (36)
Total fabric heat loss							(33) + (36) = 62.4479 (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	106.0384	105.8405	105.6465	104.7355	104.5650	103.7715	103.7715	103.6246	104.0772	104.5650	104.9099	105.2704 (39)
Average = Sum(39)m / 12 =												104.7347 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1363	1.1342	1.1321	1.1223	1.1205	1.1120	1.1120	1.1104	1.1153	1.1205	1.1242	1.1281 (40)
HLP (average)												1.1223 (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

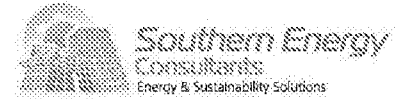
Elmhurst Energy Systems

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 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)											
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 -862.7912 (H17)											
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	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.4900	19.6403	0.4400	0.0000	0.7700	23.2229	(76)
South	0.6000	46.7521	0.4400	0.0000	0.7700	9.5038	(78)
West	4.5200	19.6403	0.4400	0.0000	0.7700	30.0766	(80)

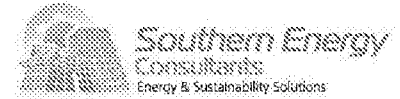
Solar gains	62.8033	119.8299	191.5365	272.8370	330.2606	336.6488	321.0656	278.2531	220.4170	140.5074	77.7234	52.0430	(83)
Total gains	678.6179	730.0120	776.8287	820.1367	838.8620	811.1808	776.2896	743.2001	707.8225	666.1282	645.3512	651.2532	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	48.7869	48.8782	48.9679	49.3938	49.4744	49.8527	49.8527	49.9234	49.7063	49.4744	49.3117	49.1429	
util living area	4.2525	4.2585	4.2645	4.2929	4.2983	4.3235	4.3235	4.3282	4.3138	4.2983	4.2874	4.2762	
	0.9895	0.9844	0.9720	0.9395	0.8659	0.7233	0.5622	0.6043	0.8176	0.9491	0.9829	0.9911	(86)
MIT	19.6798	19.8160	20.0663	20.4016	20.7035	20.9066	20.9757	20.9667	20.8318	20.4514	20.0079	19.6489	(87)
Th 2	19.9713	19.9730	19.9747	19.9826	19.9841	19.9910	19.9910	19.9923	19.9884	19.9841	19.9811	19.9780	(88)
util rest of house	0.9868	0.9802	0.9642	0.9214	0.8240	0.6398	0.4451	0.4880	0.7492	0.9303	0.9776	0.9888	(89)
MIT 2	18.2263	18.4249	18.7872	19.2681	19.6753	19.9196	19.9798	19.9754	19.8425	19.3460	18.7106	18.1860	(90)
Living area fraction	fLA = Living area / (4) =											0.2124	(91)
MIT	18.5350	18.7204	19.0589	19.5088	19.8937	20.1292	20.1913	20.1860	20.0526	19.5808	18.9861	18.4967	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3850	18.5704	18.9089	19.3588	19.7437	19.9792	20.0413	20.0360	19.9026	19.4308	18.8361	18.3467	(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	0.9806	0.9723	0.9533	0.9075	0.8123	0.6387	0.4512	0.4934	0.7424	0.9168	0.9692	0.9834	(94)
Useful gains	665.4776	709.8203	740.5408	744.2343	681.4360	518.1391	350.2806	366.6856	525.4817	610.7091	625.4464	640.4508	(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	1493.5487	1446.8821	1310.9533	1095.4087	841.0892	558.2081	357.1070	376.7740	603.9196	923.3891	1231.2321	1489.2318	(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	616.0849	495.3056	424.3869	252.8456	118.7820	0.0000	0.0000	0.0000	0.0000	232.6340	436.1657	631.4931	(98)
Space heating												3207.6976	(98)
Space heating per m2											(98) / (4) =	34.3731	(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													3544.4172 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	616.0849	495.3056	424.3869	252.8456	118.7820	0.0000	0.0000	0.0000	0.0000	232.6340	436.1657	631.4931	(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)	680.7568	547.2990	468.9358	279.3874	131.2508	0.0000	0.0000	0.0000	0.0000	257.0541	481.9510	697.7824	(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	89.8610	89.9002	89.9410	90.0152	90.0979	87.3000	87.3000	87.3000	87.3000	89.5786	89.7629	89.8768	(217)
Fuel for water heating, kWh/month	165.0250	122.6070	96.3427	48.3798	18.2766	1.7030	0.0000	28.0386	53.8362	101.2952	140.2914	163.9367	(219)
Water heating fuel used												939.7323	(219)
Annual totals kWh/year													
Space heating fuel - main system												3544.4172	(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												3334.8962	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3544.4172	3.4800	123.3457	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	939.7323	3.4800	32.7027	(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			124.4619	(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] =	0.3779	(257)
SAP value		94.7280	
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	3544.4172	0.2160	765.5941 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	939.7323	0.2160	202.9822 (264)
Space and water heating			968.5763 (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			372.1138 (272)
CO2 emissions per m2			3.9900 (273)
EI value			96.3951
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			46.6600	0.1900	8.8654	75.0000	3499.5000 (28a)
Brick/Render Cavity	101.9500	12.9100	89.0400	0.2500	22.2600	60.0000	5342.4000 (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)			195.2700				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	53.3477		(33)
Party Wall 1			40.3000	0.0000	0.0000	110.0000	4433.0000 (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) = 18623.8400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							199.5697 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.1002 (36)
Total fabric heat loss							(33) + (36) = 62.4479 (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	104.3985	104.0772	104.0772	103.6246	103.6246	103.0760	103.2073	102.9487	103.0760	103.3425	103.3425	103.7715 (39)
Average = Sum(39)m / 12 =												103.5472 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1187	1.1153	1.1153	1.1104	1.1104	1.1045	1.1060	1.1032	1.1045	1.1074	1.1074	1.1120 (40)
HLP (average)												1.1096 (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	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)	
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	-879.7230 (H17)	
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	145.8440 (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 =											831.0680 (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	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
East	3.4900	22.3313	0.4400	0.0000	0.7700	26.4048	(76)
South	0.6000	50.9848	0.4400	0.0000	0.7700	10.3642	(78)
West	4.5200	22.3313	0.4400	0.0000	0.7700	34.1976	(80)

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

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.5533	49.7063	49.7063	49.9234	49.9234	50.1891	50.1252	50.2511	50.1891	50.0597	50.0597	49.8527
alpha	4.3036	4.3138	4.3138	4.3282	4.3282	4.3459	4.3417	4.3501	4.3459	4.3373	4.3373	4.3235
util living area	0.9867	0.9812	0.9645	0.9180	0.8066	0.5848	0.3969	0.4227	0.7260	0.9255	0.9764	0.9887 (86)
MIT	19.8159	19.9330	20.1972	20.5301	20.8178	20.9685	20.9956	20.9942	20.9154	20.5846	20.1525	19.7928 (87)
Th 2	19.9856	19.9884	19.9884	19.9923	19.9923	19.9971	19.9960	19.9982	19.9971	19.9948	19.9948	19.9910 (88)
util rest of house	0.9832	0.9761	0.9543	0.8931	0.7475	0.4807	0.2708	0.2936	0.6334	0.8974	0.9689	0.9856 (89)
MIT 2	18.4339	18.6050	18.9846	19.4524	19.8223	19.9797	19.9950	19.9968	19.9370	19.5365	18.9286	18.4044 (90)
Living area fraction												
MIT	18.7274	18.8871	19.2421	19.6813	20.0337	20.1897	20.2075	20.2087	20.1448	19.7591	19.1885	18.6993 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5774	18.7371	19.0921	19.5313	19.8837	20.0397	20.0575	20.0587	19.9948	19.6091	19.0385	18.5493 (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	0.9761	0.9674	0.9424	0.8791	0.7403	0.4853	0.2786	0.3016	0.6331	0.8837	0.9590	0.9792	(94)
Useful gains	670.3640	708.2175	732.7757	728.9600	622.3309	406.0688	222.0376	231.6292	460.3730	599.3217	630.6452	643.7696	(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													
	1407.0242	1367.2679	1216.8845	998.0383	713.3209	416.3958	222.6709	232.5274	494.2324	827.6810	1140.7456	1395.6517	(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													
	548.0752	442.8819	360.1770	193.7363	67.6966	0.0000	0.0000	0.0000	0.0000	169.8993	367.2723	559.4003	(98)
Space heating													
Space heating per m2													(98) / (4) = 29.0306 (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													2993.5236 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	548.0752	442.8819	360.1770	193.7363	67.6966	0.0000	0.0000	0.0000	0.0000	169.8993	367.2723	559.4003	(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)	605.6080	489.3722	397.9856	214.0733	74.8028	0.0000	0.0000	0.0000	0.0000	187.7340	405.8257	618.1219	(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	89.8067	89.8387	89.8462	89.8890	89.7471	87.3000	87.3000	87.3000	87.3000	89.3776	89.6769	89.8191	(217)
Fuel for water heating, kWh/month	162.8330	123.8624	99.2997	49.0618	22.3888	0.0000	0.0000	22.4574	49.7883	99.0608	136.8164	162.3751	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system													2993.5236 (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													2675.2937 (238)

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

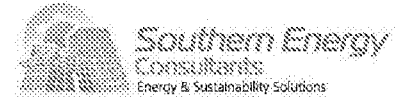
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2993.5236	3.8700	115.8494 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	927.9437	3.8700	35.9114 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Pump for solar water heating	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			9.2340 (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	2993.5236	0.2160	646.6011 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	927.9437	0.2160	200.4358 (264)
Space and water heating			847.0369 (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)

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 200.2728 (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	2993.5236	1.2200	3652.0988 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	927.9437	1.2200	1132.0913 (264)
Space and water heating			4784.1900 (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			958.4371 (272)
Primary energy kWh/m2/year			10.2704 (273)

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

Overheating Calculation Input Data

Dwelling type	EndTerrace 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	199.6 (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	62.45 (37)
Summer heat loss coefficient	370.40 (P2)

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

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

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

total: 399.3879

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

Summer gain/loss ratio	2.42	2.30	2.20	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 199.6)	0.60	0.60	0.60	
Threshold temperature	19.02	20.80	20.61	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight