

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG008c				Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	End Bri Re Ga Ea			
Property	WP3520A+, Plot 34					
SAP Rating	84 B	DER	17.61	TER	18.21	
Environmental	36 B	% DER<TER	3.29			
CO ₂ Emissions (t/year)	1.35	DPFE	49.66	TPEE	53.21	
General Requirements Compliance	Pass	% DPFE<TPEE	6.68			
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) 18.21 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.61 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.7 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	1.36 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes

OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 2.13 m², No overhang
Windows facing East: 4.52 m², No overhang
Windows facing West: 3.49 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)			10.1400	1.2357	12.5304		(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	14.4400	87.5100	0.2500	21.8775	60.0000	5250.6000 (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) =		54.8559		(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) = 18532.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5859 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4805 (36)
Total fabric heat loss							(33) + (36) = 64.3364 (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	107.9269	107.7290	107.5351	106.6240	106.4536	105.6601	105.6601	105.5131	105.9657	106.4536	106.7984	107.1589 (39)
Average = Sum(39)m / 12 =												106.6232 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1565	1.1544	1.1523	1.1426	1.1407	1.1322	1.1322	1.1307	1.1355	1.1407	1.1444	1.1483 (40)
HLP (average)												1.1426 (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)
Total per year (kWh/year) = Sum(64)m =											1700.7860 (64)
Heat gains from water heating, kWh/month											
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	133.4246	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	24.7833	22.0123	17.9016	13.5527	10.1308	8.5528	9.2416	12.0126	16.1233	20.4723	23.8942	25.4721	(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	411.7525	409.2663	394.0579	369.6882	344.9036	321.3108	306.2349	312.8116	325.5885	350.1811	378.2743	399.3802	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c		Access factor Table 6d	Gains W		
North				2.1300	10.6334	0.4400	0.0000		0.7700	7.6735 (74)		
East				4.5200	19.6403	0.4400	0.0000		0.7700	30.0766 (76)		
West				3.4900	19.6403	0.4400	0.0000		0.7700	23.2229 (80)		
Solar gains	60.9730	118.9296	196.6284	290.4542	360.8278	371.8976	352.9989	299.6849	229.6659	141.1756	75.9245	50.2280 (83)
Total gains	472.7255	528.1960	590.6864	660.1424	705.7314	693.2084	659.2338	612.4965	555.2544	491.3566	454.1988	449.6081 (84)

7. Mean internal temperature (heating season)

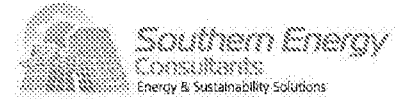
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	47.6970	47.7846	47.8708	48.2798	48.3571	48.7203	48.7203	48.7881	48.5798	48.3571	48.2010	48.0388
alpha	4.1798	4.1856	4.1914	4.2187	4.2238	4.2480	4.2480	4.2525	4.2387	4.2238	4.2134	4.2026
util living area	0.9973	0.9952	0.9893	0.9702	0.9171	0.7993	0.6491	0.7057	0.9019	0.9817	0.9953	0.9978 (86)
MIT	19.4028	19.5487	19.8290	20.2180	20.5872	20.8526	20.9554	20.9359	20.7222	20.2477	19.7577	19.3750 (87)
Th 2	19.9549	19.9566	19.9583	19.9662	19.9677	19.9746	19.9746	19.9759	19.9719	19.9677	19.9647	19.9616 (88)
util rest of house	0.9965	0.9938	0.9860	0.9601	0.8861	0.7214	0.5219	0.5833	0.8522	0.9738	0.9937	0.9972 (89)
MIT 2	17.8132	18.0274	18.4369	19.0033	19.5183	19.8548	19.9525	19.9405	19.7087	19.0528	18.3388	17.7770 (90)
Living area fraction	18.1508	18.3505	18.7326	19.2613	19.7454	20.0667	20.1655	20.1519	19.9240	19.3066	18.6402	18.1164 (92)
Temperature adjustment	18.0008	18.2005	18.5826	19.1113	19.5954	19.9167	20.0155	20.0019	19.7740	19.1566	18.4902	-0.1500
adjusted MIT	18.0008	18.2005	18.5826	19.1113	19.5954	19.9167	20.0155	20.0019	19.7740	19.1566	18.4902	17.9664 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9942	0.9903	0.9796	0.9485	0.8720	0.7162	0.5274	0.5868	0.8399	0.9646	0.9901	0.9953 (94)
Useful gains	469.9815	523.0501	578.6515	626.1640	615.3768	496.5091	347.6887	359.4121	466.3348	473.9758	449.6895	447.4836 (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	1478.6828	1432.8517	1299.2987	1088.7716	840.4893	561.7615	360.8780	380.0462	601.2491	910.8799	1216.4508	1475.1935 (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	750.4737	611.3866	536.1615	333.0775	167.4837	0.0000	0.0000	0.0000	0.0000	325.0566	552.0682	764.6161 (98)
Space heating												4040.3240 (98)
Space heating per m2												(98) / (4) = 43.2954 (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													4464.4464	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	750.4737	611.3866	536.1615	333.0775	167.4837	0.0000	0.0000	0.0000	0.0000	325.0566	552.0682	764.6161	(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)	829.2527	675.5654	592.4437	368.0414	185.0649	0.0000	0.0000	0.0000	0.0000	359.1786	610.0201	844.8797	(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	89.8819	89.8444	89.7521	89.5344	89.0480	87.3000	87.3000	87.3000	87.3000	89.4924	89.7764	89.9055	(216)	
Fuel for water heating, kWh/month	192.8223	169.1523	175.7692	155.0729	150.6997	134.2869	126.0634	142.3470	143.3625	161.0311	173.3262	187.1717	(219)	
Water heating fuel used												1911.1052	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4464.4464	(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)													437.6809	(232)
Total delivered energy for all uses													6888.2325	(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	4464.4464	0.2160	964.3204 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1911.1052	0.2160	412.7987 (264)
Space and water heating			1377.1191 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Total CO2, kg/year			1643.2005 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.6100 (273)

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

DER		17.6100	ZC1
Total Floor Area	TFA	93.3200	
Assumed number of occupants	N	2.6685	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.5609	ZC2
CO2 emissions from cooking, equation (L16)		1.9615	ZC3
Total CO2 emissions		35.1324	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		35.1324	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)			10.1400	1.3258	13.4432		(27)
Heat Loss Floor 1			46.6600	0.1300	6.0658		(28a)
Brick/Pender Cavity	101.9500	14.4400	87.5100	0.1800	15.7518		(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) =	46.0566		(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)							10.4741 (36)
Total fabric heat loss						(33) + (36) =	56.5307 (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	101.5055	101.2538	101.0072	99.8487	99.6319	98.6229	98.6229
Average = Sum(39)m / 12 =							
HLP	1.0877	1.0850	1.0824	1.0700	1.0676	1.0568	1.0568
HLP (average)							
Days in month	31	28	31	30	31	30	31
							31 (41)

4. Water heating energy requirements (kWh/year)

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	24.7833	22.0123	17.9016	13.5527	10.1308	8.5528	9.2416	12.0126	16.1233	20.4723	23.8942	25.4721	(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	424.1249	421.6428	406.3626	381.3401	355.8981	331.6499	316.5818	323.8133	337.2513	362.4967	390.6568	411.7567	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	2.1300	10.6334	0.6300		0.7000	0.7700	6.9219 (74)
East	4.5200	19.6403	0.6300		0.7000	0.7700	27.1305 (76)
West	3.4900	19.6403	0.6300		0.7000	0.7700	20.9481 (80)

Solar gains	55.0004	107.2799	177.3678	262.0029	325.4831	335.4685	318.4210	270.3294	207.1690	127.3468	68.4874	45.3079	(83)
Total gains	479.1254	528.9228	583.7304	643.3430	681.3811	667.1184	635.0029	594.1428	544.4203	489.8435	459.1442	457.0646	(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	63.8444	64.0031	64.1594	64.9038	65.0450	65.7105	65.7105	65.8352	65.4525	65.0450	64.7600	64.4647	
alpha	5.2563	5.2669	5.2773	5.3269	5.3363	5.3807	5.3807	5.3890	5.3635	5.3363	5.3173	5.2976	
util living area	0.9991	0.9982	0.9953	0.9834	0.9401	0.8190	0.6528	0.7112	0.9214	0.9902	0.9982	0.9993	(86)
MIT	19.7617	19.8775	20.0996	20.4123	20.7078	20.9132	20.9801	20.9690	20.8143	20.4369	20.0479	19.7433	(87)
Th 2	20.0109	20.0131	20.0153	20.0254	20.0274	20.0362	20.0362	20.0379	20.0328	20.0274	20.0235	20.0195	(88)
util rest of house	0.9987	0.9976	0.9935	0.9763	0.9123	0.7389	0.5250	0.5864	0.8730	0.9849	0.9974	0.9990	(89)
MIT 2	18.3467	18.5175	18.8434	19.3033	19.7160	19.9715	20.0280	20.0234	19.8648	19.3438	18.7746	18.3260	(90)
Living area fraction	18.6472	18.8064	19.1102	19.5389	19.9267	20.1715	20.2302	20.2242	20.0665	19.5759	19.0450	18.6270	(91)
MIT	18.6472	18.8064	19.1102	19.5389	19.9267	20.1715	20.2302	20.2242	20.0665	19.5759	19.0450	18.6270	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6472	18.8064	19.1102	19.5389	19.9267	20.1715	20.2302	20.2242	20.0665	19.5759	19.0450	18.6270	(93)

8. Space heating requirement

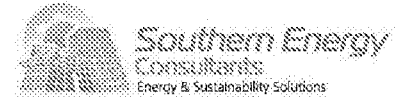
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	478.1925	527.0168	578.5429	625.0301	619.2119	501.4260	350.6808	363.9740	476.4435	480.7213	457.3947	456.3741	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1456.3221	1408.0716	1273.7247	1062.2754	819.6400	549.4781	358.0240	376.4418	590.7505	894.2897	1195.3410	1450.3285	(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	727.7284	592.0689	517.2153	314.8166	149.1185	0.0000	0.0000	0.0000	0.0000	307.6949	531.3213	739.5021	(98)
Space heating												3879.4660	(98)
Space heating per m ²												41.5716	(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													4153.6038 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	727.7284	592.0689	517.2153	314.8166	149.1185	0.0000	0.0000	0.0000	0.0000	307.6949	531.3213	739.5021	(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)	779.1524	633.9067	553.7637	337.0627	159.6558	0.0000	0.0000	0.0000	0.0000	329.4378	568.8665	791.7581	(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	87.9222	87.7692	87.3973	86.5481	84.7688	80.3000	80.3000	80.3000	80.3000	86.3793	87.4873	87.9967	(216)
Fuel for water heating, kWh/month	238.9983	211.0556	222.4042	199.1969	196.9058	183.0748	175.3996	195.5295	197.6889	209.2652	218.6234	233.0884	(219)
Water heating fuel used												2481.2306	(219)
Annual totals kWh/year													
Space heating fuel - main system												4153.6038	(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)												437.6809	(232)
Total delivered energy for all uses												7147.5153	(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	4153.6038	0.2160	897.1784 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2481.2306	0.2160	535.9458 (264)
Space and water heating			1433.1242 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Total CO2, kg/m2/year			1699.2056 (272)
Emissions per m2 for space and water heating			15.3571 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.4342 (272b)
Emissions per m2 for pumps and fans			0.4171 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.3571 * 1.00) + 2.4342 + 0.4171, rounded to 2 d.p.			18.2100 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			10.1400	1.2357	12.5304		(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	14.4400	87.5100	0.2500	21.8775	60.0000	5250.6000 (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) =	54.8559			(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) =	18112.1000			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							194.0859 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4805 (36)
Total fabric heat loss			(33) + (36) =	64.3364			(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	109.3112	109.0596	108.8129	107.6544	107.4376	106.4286	106.4286	106.2417	106.8173	107.4376	107.8761	108.3346 (39)
Average = Sum(39)m / 12 =												107.6534 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1714	1.1687	1.1660	1.1536	1.1513	1.1405	1.1405	1.1385	1.1446	1.1513	1.1560	1.1609 (40)
HLP (average)												1.1536 (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	24.7833	22.0123	17.9016	13.5527	10.1308	8.5528	9.2416	12.0126	16.1233	20.4723	23.8942	25.4721	(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	378.3284	376.6598	363.1497	341.0920	317.8093	296.3289	283.0453	287.3221	299.2793	321.4794	346.8748	366.7703	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			2.1300		10.6334		0.4400		0.0000		0.7700		7.6735 (74)
East			4.5200		19.6403		0.4400		0.0000		0.7700		30.0766 (76)
West			3.4900		19.6403		0.4400		0.0000		0.7700		23.2229 (80)
Solar gains	60.9730	118.9296	196.6284	290.4542	360.8278	371.8976	352.9989	299.6849	229.6659	141.1756	75.9245	50.2280	(83)
Total gains	439.3015	495.5895	559.7781	631.5462	678.6371	668.2265	636.0441	587.0070	528.9452	462.6550	422.7993	416.9982	(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	46.0258	46.1320	46.2366	46.7342	46.8285	47.2724	47.2724	47.3556	47.1004	46.8285	46.6381	46.4408	
alpha	4.0684	4.0755	4.0824	4.1156	4.1219	4.1515	4.1515	4.1570	4.1400	4.1219	4.1092	4.0961	
util living area	0.9977	0.9959	0.9906	0.9732	0.9245	0.8135	0.6676	0.7261	0.9126	0.9844	0.9960	0.9982	(86)
MIT	19.3121	19.4631	19.7534	20.1595	20.5456	20.8315	20.9465	20.9234	20.6887	20.1910	19.6834	19.2879	(87)
Th 2	19.9430	19.9452	19.9473	19.9573	19.9592	19.9679	19.9679	19.9695	19.9645	19.9592	19.9554	19.9514	(88)
util rest of house	0.9970	0.9947	0.9877	0.9640	0.8957	0.7381	0.5396	0.6045	0.8670	0.9776	0.9947	0.9976	(89)
MIT 2	18.3953	18.5476	18.8383	19.2469	19.6176	19.8723	19.9492	19.9396	19.7591	19.2830	18.7757	18.3776	(90)
Living area fraction	fLA = Living area / (4) =												0.2124 (91)
MIT	18.5900	18.7420	19.0326	19.4407	19.8147	20.0760	20.1610	20.1486	19.9565	19.4758	18.9685	18.5710	(92)
Temperature adjustment													0.0000
adjusted MIT	18.5900	18.7420	19.0326	19.4407	19.8147	20.0760	20.1610	20.1486	19.9565	19.4758	18.9685	18.5710	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	437.4875	492.0221	550.9770	605.1179	604.5504	499.3062	359.8114	368.7345	458.3574	450.2664	419.6051	415.6120	(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	1562.0564	1509.6078	1363.7121	1134.7566	871.8223	582.8055	378.9957	398.2557	625.5802	953.5990	1280.3252	1556.8722	(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	836.6793	683.8176	604.6749	381.3398	198.8503	0.0000	0.0000	0.0000	0.0000	374.4795	619.5745	849.0976	(98)
Space heating													4548.5135 (98)
Space heating per m2	(98) / (4) =												48.7410 (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	1000.4287	787.5716	807.4372	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	0.7528	0.8326	0.7965	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	753.1438	655.7556	643.1285	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	883.4879	843.8225	788.6884	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	93.8477	139.9218	108.2966	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												342.0661 (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	23.4619	34.9804	27.0741	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												85.5165 (107)
Space cooling per m2												0.9164 (108)
Energy for space heating												48.7410 (99)
Energy for space cooling												0.9164 (108)
Total												49.6574 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.7 (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	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 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)			10.1400	1.3258	13.4432			(27)					
Heat Loss Floor 1			46.6600	0.1300	6.0658			(28a)					
Brick/Render Cavity	101.9500	14.4400	87.5100	0.1800	15.7518			(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) =	46.0566			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								10.4741 (36)					
Total fabric heat loss						(33) + (36) =		56.5307 (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	101.5055	101.2538	101.0072	99.8487	99.6319	98.6229	98.6229	98.4360	99.0115	99.6319	100.0704	100.5288	(39)
Average = Sum(39)m / 12 =												99.8476	(39)
HLP	Jan 1.0877	Feb 1.0850	Mar 1.0824	Apr 1.0700	May 1.0676	Jun 1.0568	Jul 1.0568	Aug 1.0548	Sep 1.0610	Oct 1.0676	Nov 1.0723	Dec 1.0772	(40)
HLP (average)												1.0699	(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)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	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	24.7833	22.0123	17.9016	13.5527	10.1308	8.5528	9.2416	12.0126	16.1233	20.4723	23.8942	25.4721	(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	378.3284	376.6598	363.1497	341.0920	317.8093	296.3289	283.0453	287.3221	299.2793	321.4794	346.8748	366.7703	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.1300	10.6334	0.6300	0.7000	0.7700	6.9219 (74)
East	4.5200	19.6403	0.6300	0.7000	0.7700	27.1305 (76)
West	3.4900	19.6403	0.6300	0.7000	0.7700	20.9481 (80)

Solar gains	55.0004	107.2799	177.3678	262.0029	325.4831	335.4685	318.4210	270.3294	207.1690	127.3468	68.4874	45.3079	(83)
Total gains	433.3289	483.9398	540.5175	603.0949	643.2924	631.7974	601.4663	557.6515	506.4484	448.8262	415.3621	412.0782	(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	63.8444	64.0031	64.1594	64.9038	65.0450	65.7105	65.7105	65.8352	65.4525	65.0450	64.7600	64.4647	
alpha	5.2563	5.2669	5.2773	5.3269	5.3363	5.3807	5.3807	5.3890	5.3635	5.3363	5.3173	5.2976	
util living area	0.9994	0.9988	0.9967	0.9875	0.9516	0.8429	0.6818	0.7444	0.9390	0.9934	0.9989	0.9996	(86)
MIT	19.7153	19.8320	20.0566	20.3743	20.6787	20.8990	20.9756	20.9614	20.7876	20.3969	20.0036	19.6976	(87)
Th 2	20.0109	20.0131	20.0153	20.0254	20.0274	20.0362	20.0362	20.0379	20.0328	20.0274	20.0235	20.0195	(88)
util rest of house	0.9992	0.9984	0.9954	0.9820	0.9278	0.7668	0.5519	0.6197	0.8981	0.9898	0.9984	0.9994	(89)
MIT 2	18.8283	18.9467	19.1725	19.4958	19.7895	19.9833	20.0292	20.0251	19.8972	19.5216	19.1266	18.8175	(90)
Living area fraction	19.0167	19.1347	19.3603	19.6824	19.9783	20.1778	20.2302	20.2239	20.0863	19.7075	19.3129	19.0044	(91)
MIT	19.0167	19.1347	19.3603	19.6824	19.9783	20.1778	20.2302	20.2239	20.0863	19.7075	19.3129	19.0044	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0167	19.1347	19.3603	19.6824	19.9783	20.1778	20.2302	20.2239	20.0863	19.7075	19.3129	19.0044	(93)

8. Space heating requirement

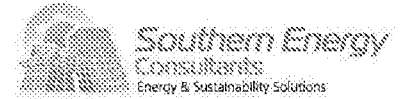
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	432.8686	482.9135	537.4175	590.6704	595.8987	492.5426	348.7929	360.4027	456.3165	443.4643	414.4784	411.7472	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(95)
Heat loss rate W	1493.8243	1441.3207	1298.9804	1076.6044	824.7876	550.0992	358.0174	376.4141	592.7153	907.3949	1222.1475	1488.2737	(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	789.3510	644.0496	566.6028	349.8725	170.2934	0.0000	0.0000	0.0000	0.0000	345.1644	581.5217	800.9357	(98)
Space heating												4247.7912	(98)
Space heating per m ²												(98) / (4) =	45.5186 (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	927.0548	729.8091	748.1136	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7994	0.8808	0.8470	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	741.1125	642.8189	633.6342	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	840.9085	803.4069	754.3768	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	71.8531	119.4774	89.8325	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												281.1630 (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	17.9633	29.8694	22.4581	0.0000	0.0000	0.0000	0.0000 (107)	
Space cooling												70.2908 (107)
Space cooling per m2												0.7532 (108)
Energy for space heating												45.5166 (99)
Energy for space cooling												0.7532 (108)
Total												46.2718 (109)
Target Fabric Energy Efficiency (TFEE)												53.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			10.1400	1.2357	12.5304		(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	14.4400	87.5100	0.2500	21.8775	60.0000	5250.6000 (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) =		54.8559		(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) =	18532.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5859 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4805 (36)
Total fabric heat loss						(33) + (36) =	64.3364 (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	106.2870	105.9657	105.9657	105.5131	105.5131	104.9645	105.0958	104.8372	104.9645	105.2310	105.2310	105.6601 (39)
Average = Sum(39)m / 12 =												105.4357 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1390	1.1355	1.1355	1.1307	1.1307	1.1248	1.1262	1.1234	1.1248	1.1276	1.1276	1.1322 (40)
HLP (average)												1.1298 (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	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803 (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	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d		Gains W		
North				2.1300	11.9814	0.4400	0.0000	0.7700		8.6463 (74)		
East				4.5200	22.3313	0.4400	0.0000	0.7700		34.1976 (76)		
West				3.4900	22.3313	0.4400	0.0000	0.7700		26.4048 (80)		

Solar gains	69.2488	121.6396	198.6011	301.8125	364.6541	401.8926	377.4761	328.1827	251.3000	154.1811	88.3677	56.4737 (83)
Total gains	682.8968	729.8974	782.3283	847.9274	872.3699	875.6769	831.8922	792.0795	737.2960	678.0122	653.9066	653.4571 (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	48.4329	48.5798	48.5798	48.7881	48.7881	49.0431	48.9819	49.1027	49.0431	48.9189	48.9189	48.7203
alpha	4.2289	4.2387	4.2387	4.2525	4.2525	4.2695	4.2655	4.2735	4.2695	4.2613	4.2613	4.2480
util living area	0.9870	0.9815	0.9642	0.9144	0.7961	0.5704	0.3872	0.4173	0.7257	0.9271	0.9771	0.9889 (86)
MIT	19.7761	19.8963	20.1720	20.5223	20.8194	20.9694	20.9956	20.9940	20.9109	20.5645	20.1195	19.7528 (87)
Th 2	19.9691	19.9719	19.9719	19.9759	19.9759	19.9806	19.9795	19.9818	19.9806	19.9783	19.9783	19.9746 (88)
util rest of house	0.9835	0.9764	0.9539	0.8887	0.7353	0.4663	0.2621	0.2878	0.6322	0.8993	0.9697	0.9858 (89)
MIT 2	18.3657	18.5413	18.9374	19.4287	19.8087	19.9639	19.9786	19.9803	19.9175	19.4973	18.8703	18.3358 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.6652	18.8291	19.1996	19.6609	20.0233	20.1774	20.1946	20.1956	20.1285	19.7240	19.1357	18.6367 (92)
Temperature adjustment												
adjusted MIT	18.5152	18.6791	19.0496	19.5109	19.8733	20.0274	20.0446	20.0456	19.9785	19.5740	18.9857	18.4867 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9763	0.9676	0.9417	0.8744	0.7284	0.4714	0.2702	0.2961	0.6319	0.8852	0.9597	0.9794 (94)
Useful gains	666.7335	706.2692	736.6916	741.4008	635.4365	412.7642	224.7570	234.4960	465.9321	600.1760	627.5359	639.9994 (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	1425.8636	1385.9343	1234.4592	1014.0805	725.2280	422.7387	225.3837	235.4241	501.5689	839.1114	1156.0312	1414.4421 (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	564.7928	456.7350	370.3391	196.3294	66.8049	0.0000	0.0000	0.0000	0.0000	177.7679	380.5166	576.1854 (98)
Space heating												2789.4710 (98)
RHI space heating demand												2789 (98)

FULL SAP CALCULATION PRINTOUT

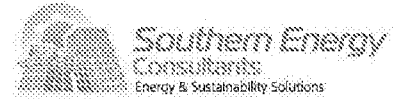
Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

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

2. Ventilation rate

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

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			10.1400	1.2357	12.5304		(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	14.4400	87.5100	0.2500	21.8775	60.0000	5250.6000 (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) =	54.8559			(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) =	18532.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5859 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4805 (36)
Total fabric heat loss						(33) + (36) =	64.3364 (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	107.9269	107.7290	107.5351	106.6240	106.4536	105.6601	105.6601	105.5131	105.9657	106.4536	106.7984	107.1589 (39)
Average = Sum(39)m / 12 =												106.6232 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1565	1.1544	1.1523	1.1426	1.1407	1.1322	1.1322	1.1307	1.1355	1.1407	1.1444	1.1483 (40)
HLP (average)												1.1426 (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

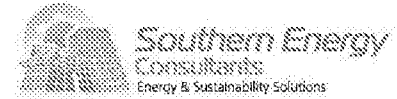
Elmhurst Energy Systems

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	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (64)
Total per year (kWh/year) = Sum(64)m =											1700.7860 (64)
Heat gains from water heating, kWh/month											
56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126	54.7869 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	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	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803	(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	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North			2.1300		10.6334		0.4400		0.0000		0.7700		7.6735 (74)
East			4.5200		19.6403		0.4400		0.0000		0.7700		30.0766 (76)
West			3.4900		19.6403		0.4400		0.0000		0.7700		23.2229 (80)
Solar gains	60.9730	118.9296	196.6284	290.4542	360.8278	371.8976	352.9989	299.6849	229.6659	141.1756	75.9245	50.2280	(83)
Total gains	674.6210	727.1875	780.3556	836.5691	868.5435	845.6819	807.4150	763.5817	715.6618	665.0066	641.4634	647.2113	(84)

7. Mean internal temperature (heating season)

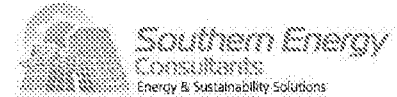
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	47.6970	47.7846	47.8708	48.2798	48.3571	48.7203	48.7203	48.7881	48.5798	48.3571	48.2010	48.0388
alpha	4.1798	4.1856	4.1914	4.2187	4.2238	4.2480	4.2480	4.2525	4.2387	4.2238	4.2134	4.2026
util living area	0.9896	0.9846	0.9718	0.9369	0.8575	0.7099	0.5510	0.5985	0.8177	0.9501	0.9832	0.9913 (86)
MIT	19.6382	19.7772	20.0380	20.3905	20.7047	20.9085	20.9759	20.9658	20.8240	20.4277	19.9727	19.6070 (87)
Th 2	19.9549	19.9566	19.9583	19.9662	19.9677	19.9746	19.9746	19.9759	19.9719	19.9677	19.9647	19.9616 (88)
util rest of house	0.9869	0.9805	0.9639	0.9182	0.8139	0.6251	0.4338	0.4813	0.7487	0.9316	0.9781	0.9890 (89)
MIT 2	18.1555	18.3581	18.7356	19.2402	19.6622	19.9053	19.9635	19.9586	19.8193	19.3015	18.6491	18.1146 (90)
Living area fraction	18.4704	18.6595	19.0122	19.4845	19.8836	20.1184	20.1785	20.1725	20.0327	19.5407	18.9302	18.4316 (92)
MIT	18.3204	18.5095	18.8622	19.3345	19.7336	19.9684	20.0285	20.0225	19.8827	19.3907	18.7802	18.2816 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.2816 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9808	0.9725	0.9527	0.9038	0.8023	0.6246	0.4403	0.4870	0.7417	0.9178	0.9696	0.9835 (94)
Useful gains	661.6502	707.1872	743.4769	756.0545	696.7976	528.1875	355.5239	371.8873	530.7819	610.3727	621.9489	636.5434 (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	1513.1775	1466.1401	1329.3680	1112.5713	855.2039	567.2217	362.2585	382.2234	612.7698	935.8022	1247.4262	1508.9670 (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	633.5364	510.0164	435.9030	256.6921	117.8543	0.0000	0.0000	0.0000	0.0000	242.1195	450.3436	649.0831 (98)
Space heating												3295.5484 (98)
Space heating per m2												(98) / (4) = 35.3145 (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													3641.4900 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	633.5364	510.0164	435.9030	256.6921	117.8543	0.0000	0.0000	0.0000	0.0000	242.1195	450.3436	649.0831	(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)	700.0402	563.5540	481.6608	283.6377	130.2257	0.0000	0.0000	0.0000	0.0000	267.5354	497.6173	717.2189	(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	89.7930	89.7448	89.6270	89.3503	88.7676	87.3000	87.3000	87.3000	87.3000	89.2789	89.6561	89.8222	(217)
Fuel for water heating, kWh/month	193.0132	169.3399	176.0145	155.3925	151.1758	134.2869	126.0634	142.3470	143.3625	161.4161	173.5588	187.3455	(219)
Water heating fuel used												1913.3160	(219)
Annual totals kWh/year													
Space heating fuel - main system												3641.4900	(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)												437.6809	(232)
Total delivered energy for all uses												6067.4869	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3641.4900	3.4800	126.7239 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1913.3160	3.4800	66.5834 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	437.6809	13.1900	57.7301 (250)
Additional standing charges			120.0000 (251)
Total energy cost			380.9299 (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] = 1.1567 (257)
SAP value	83.8645
SAP rating (Section 12)	B (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3641.4900	0.2160	786.5618 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1913.3160	0.2160	413.2763 (264)
Space and water heating			1199.8381 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Total kg/year			1465.9195 (272)
CO2 emissions per m2			15.7100 (273)
EI value			85.7986
EI rating			B (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8877 = 3.920$, stars = 4
Water heating environmental impact	$0.216 / 0.8877 = 0.2433$, 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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor				(20) = 1 - [0.075 x (19)] =	0.8500 (20)
Infiltration rate adjusted to include shelter factor				(21) = (18) x (20) =	0.2854 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			10.1400	1.2357	12.5304		(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	14.4400	87.5100	0.2500	21.8775	60.0000	5250.6000 (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) =		54.8559		(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) =	18532.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5859 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4805 (36)
Total fabric heat loss						(33) + (36) =	64.3364 (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	106.2870	105.9657	105.9657	105.5131	105.5131	104.9645	105.0958	104.8372	104.9645	105.2310	105.2310	105.6601 (39)
Average = Sum(39)m / 12 =												105.4357 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1390	1.1355	1.1355	1.1307	1.1307	1.1248	1.1262	1.1234	1.1248	1.1276	1.1276	1.1322 (40)
HLP (average)												1.1298 (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

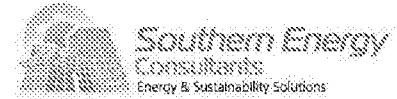
Elmhurst Energy Systems

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	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803	(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	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d	Gains W	
North					2.1300	11.9814	0.4400	0.0000			0.7700	8.6463 (74)	
East					4.5200	22.3313	0.4400	0.0000			0.7700	34.1976 (76)	
West					3.4900	22.3313	0.4400	0.0000			0.7700	26.4048 (80)	
Solar gains	69.2488	121.6396	198.6011	301.8125	364.6541	401.8926	377.4761	328.1827	251.3000	154.1811	88.3677	56.4737	(83)
Total gains	682.8968	729.8974	782.3283	847.9274	872.3699	875.6769	831.8922	792.0795	737.2960	678.0122	653.9066	653.4571	(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	48.4329	48.5798	48.5798	48.7881	48.7881	49.0431	48.9819	49.1027	49.0431	48.9189	48.9189	48.7203
alpha	4.2289	4.2387	4.2387	4.2525	4.2525	4.2695	4.2655	4.2735	4.2695	4.2613	4.2613	4.2480
util living area	0.9870	0.9815	0.9642	0.9144	0.7961	0.5704	0.3872	0.4173	0.7257	0.9271	0.9771	0.9889 (86)
MIT	19.7761	19.8963	20.1720	20.5223	20.8194	20.9694	20.9956	20.9940	20.9109	20.5645	20.1195	19.7528 (87)
Th 2	19.9691	19.9719	19.9719	19.9759	19.9759	19.9806	19.9795	19.9818	19.9806	19.9783	19.9783	19.9746 (88)
util rest of house	0.9835	0.9764	0.9539	0.8887	0.7353	0.4663	0.2621	0.2878	0.6322	0.8993	0.9697	0.9858 (89)
MIT 2	18.3657	18.5413	18.9374	19.4287	19.8087	19.9639	19.9786	19.9803	19.9175	19.4973	18.8703	18.3358 (90)
Living area fraction	18.6652	18.8291	19.1996	19.6609	20.0233	20.1774	20.1946	20.1956	20.1285	19.7240	19.1357	18.6367 (91)
MIT	18.6652	18.8291	19.1996	19.6609	20.0233	20.1774	20.1946	20.1956	20.1285	19.7240	19.1357	18.6367 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5152	18.6791	19.0496	19.5109	19.8733	20.0274	20.0446	20.0456	19.9785	19.5740	18.9857	18.4867 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9763	0.9676	0.9417	0.8744	0.7284	0.4714	0.2702	0.2961	0.6319	0.8852	0.9597	0.9794 (94)
Useful gains	666.7335	706.2692	736.6916	741.4008	635.4365	412.7642	224.7570	234.4960	465.9321	600.1760	627.5359	639.9994 (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	1425.8636	1385.9343	1234.4592	1014.0805	725.2280	422.7387	225.3837	235.4241	501.5689	839.1114	1156.0312	1414.4421 (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	564.7928	456.7350	370.3391	196.3294	66.8049	0.0000	0.0000	0.0000	0.0000	177.7679	380.5166	576.1854 (98)
Space heating												2789.4710 (98)
Space heating per m2												29.8915 (99)
										(98) / (4) =		

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													3082.2884 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	564.7928	456.7350	370.3391	196.3294	66.8049	0.0000	0.0000	0.0000	0.0000	177.7679	380.5166	576.1854	(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)	624.0805	504.6795	409.2145	216.9385	73.8175	0.0000	0.0000	0.0000	0.0000	196.4286	420.4603	636.6689	(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	89.7277	89.6793	89.5198	89.1464	88.3382	87.3000	87.3000	87.3000	87.3000	89.0388	89.5473	89.7563	(216)
Fuel for water heating, kWh/month	193.1536	169.4636	176.2253	155.7480	151.9108	134.2869	126.0634	142.3470	143.3625	161.8515	173.7696	187.4829	(219)
Water heating fuel used												1915.6650	(219)
Annual totals kWh/year													
Space heating fuel - main system												3082.2884	(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)												437.6809	(232)
Total delivered energy for all uses												5510.6343	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3082.2884	3.8700	119.2846 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1915.6650	3.8700	74.1362 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	437.6809	18.9000	82.7217 (250)
Additional standing charges			93.0000 (251)
Total energy cost			383.3175 (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	3082.2884	0.2160	665.7743 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1915.6650	0.2160	413.7836 (264)
Space and water heating			1079.5579 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Total kg/year			1345.6393 (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	3082.2884	1.2200	3760.3918 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1915.6650	1.2200	2337.1113 (264)
Space and water heating			6097.5031 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	437.6809	3.0700	1343.6803 (268)
Primary energy kWh/year			7671.4334 (272)
Primary energy kWh/m2/year			82.2057 (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 (13.9%)
U Solar photovoltaic panels	+ 9.7	-£ 345	-947 kg (81.7%)

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	£97	£106	-£9
Mains gas	£286	£248	£38
Space heating	£226	£226	£0
Water heating	£74	£45	£29
Lighting	£83	£83	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£383	£9	£374
Total cost of uses	£383	£9	£374
Delivered energy	59 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	11 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)			10.1400	1.2357	12.5304		(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	14.4400	87.5100	0.2500	21.8775	60.0000	5250.6000 (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) =	54.8559			(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) = 18532.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5859 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4805 (36)
Total fabric heat loss							(33) + (36) = 64.3364 (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	107.9269	107.7290	107.5351	106.6240	106.4536	105.6601	105.6601	105.5131	105.9657	106.4536	106.7984	107.1589 (39)
Average = Sum(39)m / 12 =												106.6232 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1565	1.1544	1.1523	1.1426	1.1407	1.1322	1.1322	1.1307	1.1355	1.1407	1.1444	1.1483 (40)
HLP (average)												1.1426 (40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

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

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1535.2611 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.8761	20.8822	21.5485	18.7865	18.0261	15.5552	14.4141	16.5404	16.7380	19.5065	21.2929	23.1227 (46)
Water storage loss:											
Total storage loss											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage											
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.1386	12.7594	14.0997	13.6002	14.0211	13.5314	13.9591	13.9993	13.5689	14.0672	13.6535 (61)
Total heat required for water heating calculated for each month											
173.3123	151.9738	157.7565	138.8437	134.1952	117.2324	110.0534	124.2689	125.1555	144.1106	155.6060	168.2778 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-25.0192	-41.7499	-71.1048	-95.2945	-117.7283	-115.7457	-114.2161	-99.7912	-78.1565	-53.3717	-29.6764
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
Heat gains from water heating, kWh/month	56.4599	49.4786	51.2908	45.0435	43.4632	37.8634	35.4411	40.1645	40.4948	46.7562	50.6126
Solar input (sum of months) = Sum(63)m =											
-862.7912											
Total per year (kWh/year) = Sum(64)m =											
842.1575											

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	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803 (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	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834 (73)

6. Solar gains

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

North	2.1300	10.6334	0.4400	0.0000	0.7700	7.6735 (74)
East	4.5200	19.6403	0.4400	0.0000	0.7700	30.0766 (76)
West	3.4900	19.6403	0.4400	0.0000	0.7700	23.2229 (80)

Solar gains	60.9730	118.9296	196.6284	290.4542	360.8278	371.8976	352.9989	299.6849	229.6659	141.1756	75.9245	50.2280 (83)
Total gains	674.6210	727.1875	780.3556	836.5691	868.5435	845.6819	807.4150	763.5817	715.6618	665.0066	641.4634	647.2113 (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	47.6970	47.7846	47.8708	48.2798	48.3571	48.7203	48.7203	48.7881	48.5798	48.3571	48.2010	48.0388
alpha	4.1798	4.1856	4.1914	4.2187	4.2238	4.2480	4.2480	4.2525	4.2387	4.2238	4.2134	4.2026
util living area	0.9896	0.9846	0.9718	0.9369	0.8575	0.7099	0.5510	0.5985	0.8177	0.9501	0.9832	0.9913 (86)
MIT	19.6382	19.7772	20.0380	20.3905	20.7047	20.9085	20.9759	20.9658	20.8240	20.4277	19.9727	19.6070 (87)
Th 2	19.9549	19.9566	19.9583	19.9662	19.9677	19.9746	19.9746	19.9759	19.9719	19.9677	19.9647	19.9616 (88)
util rest of house	0.9869	0.9805	0.9639	0.9182	0.8139	0.6251	0.4338	0.4813	0.7487	0.9316	0.9781	0.9890 (89)
MIT 2	18.1555	18.3581	18.7356	19.2402	19.6622	19.9053	19.9635	19.9586	19.8193	19.3015	18.6491	18.1146 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.4704	18.6595	19.0122	19.4845	19.8836	20.1184	20.1785	20.1725	20.0327	19.5407	18.9302	18.4316 (91)
Temperature adjustment	-0.1500											
adjusted MIT	18.3204	18.5095	18.8622	19.3345	19.7336	19.9684	20.0285	20.0225	19.8827	19.3907	18.7802	18.2816 (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	0.9808	0.9725	0.9527	0.9038	0.8023	0.6246	0.4403	0.4870	0.7417	0.9178	0.9696	0.9835	(94)
Useful gains	661.6502	707.1872	743.4769	756.0545	696.7976	528.1875	355.5239	371.8873	530.7819	610.3727	621.9489	636.5434	(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	1513.1775	1466.1401	1329.3680	1112.5713	855.2039	567.2217	362.2585	382.2234	612.7698	935.8022	1247.4262	1508.9670	(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	633.5364	510.0164	435.9030	256.6921	117.8543	0.0000	0.0000	0.0000	0.0000	242.1195	450.3436	649.0831	(98)
Space heating												3295.5484	(98)
Space heating per m2											(98) / (4) =	35.3145	(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													3641.4900	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	633.5364	510.0164	435.9030	256.6921	117.8543	0.0000	0.0000	0.0000	0.0000	242.1195	450.3436	649.0831	(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)	700.0402	563.5540	481.6608	283.6377	130.2257	0.0000	0.0000	0.0000	0.0000	267.5354	497.6173	717.2189	(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	89.8751	89.9143	89.9532	90.0214	90.0951	87.3000	87.3000	87.3000	87.3000	89.6046	89.7809	89.8904	(217)	
Fuel for water heating, kWh/month	164.9990	122.5877	96.3296	48.3765	18.2772	1.7030	0.0000	28.0386	53.8362	101.2659	140.2633	163.9117	(219)	
Water heating fuel used												939.5887	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3641.4900	(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)													437.6809	(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													3416.5202	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3641.4900	3.4800	126.7239	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	939.5887	3.4800	32.6977	(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	437.6809	13.1900	57.7301	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			125.8163	(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] =	0.3820	(257)
SAP value		94.6706	
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	3641.4900	0.2160	786.5618 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	939.5887	0.2160	202.9512 (264)
Space and water heating			989.5130 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	437.6809	0.5190	227.1564 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			385.1071 (272)
CO2 emissions per m2			4.1300 (273)
EI value			96.2692
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	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					2 * 10 = 20.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					20.0000 / (5) = 0.0857 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3357 (18)
Number of sides sheltered					2 (19)
Shelter factor			(20) = 1 - [0.075 x (19)]	=	0.8500 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20)	=	0.2854 (21)

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

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			10.1400	1.2357	12.5304		(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	14.4400	87.5100	0.2500	21.8775	60.0000	5250.6000 (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) =		54.8559		(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) =	18532.0400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							198.5859 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.4805 (36)
Total fabric heat loss						(33) + (36) =	64.3364 (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	106.2870	105.9657	105.9657	105.5131	105.5131	104.9645	105.0958	104.8372	104.9645	105.2310	105.2310	105.6601 (39)
Average = Sum(39)m / 12 =												105.4357 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1390	1.1355	1.1355	1.1307	1.1307	1.1248	1.1262	1.1234	1.1248	1.1276	1.1276	1.1322 (40)
HLP (average)												1.1298 (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												3.0000 (H1)	
Zero-loss collector efficiency												0.7000 (H2)	
Collector heat loss coefficient												1.8000 (H3)	
Collector 2nd order heat loss coefficient												0.0050 (H3a)	
Collector effective heat loss coefficient												1.8063 (H3b)	
Collector performance ratio												2.5804 (H4)	
Annual solar radiation per m2												1140.0998 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												1915.3676 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.2476 (H8)	
Utilisation factor												0.5514 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												97.5767 (H14)	
Volume ratio Veff/V												0.7686 (H15)	
Solar storage volume factor												0.9474 (H16)	
Solar input												-879.7230 (H17)	
Solar input	-27.0774	-40.6973	-68.5395	-94.7425	-114.1018	-120.0872	-117.2037	-104.6636	-81.6903	-55.5724	-32.9133	-22.4338 (63)	
	Solar input (sum of months) = Sum(63)m =											-879.7230 (63)	
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)	
	Total per year (kWh/year) = Sum(64)m =											831.0680 (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	61.9583	55.0308	44.7540	33.8817	25.3270	21.3821	23.1041	30.0316	40.3083	51.1807	59.7354	63.6803	(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	613.6480	608.2578	583.7272	546.1149	507.7157	473.7843	454.4161	463.8968	485.9960	523.8311	565.5389	596.9834	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	2.1300	11.9814	0.4400	0.0000	0.7700	8.6463 (74)
East	4.5200	22.3313	0.4400	0.0000	0.7700	34.1976 (76)
West	3.4900	22.3313	0.4400	0.0000	0.7700	26.4048 (80)

Solar gains	69.2488	121.6396	198.6011	301.8125	364.6541	401.8926	377.4761	328.1827	251.3000	154.1811	88.3677	56.4737	(83)
Total gains	682.8968	729.8974	782.3283	847.9274	872.3699	875.6769	831.8922	792.0795	737.2960	678.0122	653.9066	653.4571	(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	48.4329	48.5798	48.5798	48.7881	48.7881	49.0431	48.9819	49.1027	49.0431	48.9189	48.9189	48.7203
alpha	4.2289	4.2387	4.2387	4.2525	4.2525	4.2695	4.2655	4.2735	4.2695	4.2613	4.2613	4.2480
util living area	0.9870	0.9815	0.9642	0.9144	0.7961	0.5704	0.3872	0.4173	0.7257	0.9271	0.9771	0.9889 (86)
MIT	19.7761	19.8963	20.1720	20.5223	20.8194	20.9694	20.9956	20.9940	20.9109	20.5645	20.1195	19.7528 (87)
Th 2	19.9691	19.9719	19.9719	19.9759	19.9759	19.9806	19.9795	19.9818	19.9806	19.9783	19.9783	19.9746 (88)
util rest of house	0.9835	0.9764	0.9539	0.8887	0.7353	0.4663	0.2621	0.2878	0.6322	0.8993	0.9697	0.9858 (89)
MIT 2	18.3657	18.5413	18.9374	19.4287	19.8087	19.9639	19.9786	19.9803	19.9175	19.4973	18.8703	18.3358 (90)
Living area fraction	fLA = Living area / (4) = 0.2124 (91)											
MIT	18.6652	18.8291	19.1996	19.6609	20.0233	20.1774	20.1946	20.1956	20.1285	19.7240	19.1357	18.6367 (92)
Temperature adjustment	-0.1500											
adjusted MIT	18.5152	18.6791	19.0496	19.5109	19.8733	20.0274	20.0446	20.0456	19.9785	19.5740	18.9857	18.4867 (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	0.9763	0.9676	0.9417	0.8744	0.7284	0.4714	0.2702	0.2961	0.6319	0.8852	0.9597	0.9794	(94)
Useful gains	666.7335	706.2692	736.6916	741.4008	635.4365	412.7642	224.7570	234.4960	465.9321	600.1760	627.5359	639.9994	(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	1425.8636	1385.9343	1234.4592	1014.0805	725.2280	422.7387	225.3837	235.4241	501.5689	839.1114	1156.0312	1414.4421	(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	564.7928	456.7350	370.3391	196.3294	66.8049	0.0000	0.0000	0.0000	0.0000	177.7679	380.5166	576.1854	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 29.8915 (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													3082.2884 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	564.7928	456.7350	370.3391	196.3294	66.8049	0.0000	0.0000	0.0000	0.0000	177.7679	380.5166	576.1854	(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)	624.0805	504.6795	409.2145	216.9385	73.8175	0.0000	0.0000	0.0000	0.0000	196.4286	420.4603	636.6689	(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	89.8228	89.8548	89.8605	89.8956	89.7394	87.3000	87.3000	87.3000	87.3000	89.4104	89.6983	89.8349	(217)
Fuel for water heating, kWh/month	162.8037	123.8403	99.2838	49.0582	22.3907	0.0000	0.0000	22.4574	49.7883	99.0245	136.7837	162.3467	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3082.2884 (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)													437.6809 (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													2748.5869 (238)

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

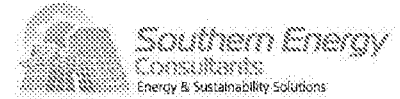
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3082.2884	3.8700	119.2846	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	927.7773	3.8700	35.9050	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	437.6809	18.9000	82.7217	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			9.7701	(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	3082.2884	0.2160	665.7743	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	927.7773	0.2160	200.3999	(264)
Space and water heating			866.1742	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	437.6809	0.5190	227.1564	(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

211.4667 (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	3082.2884	1.2200	3760.3918 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	927.7773	1.2200	1131.8883 (264)
Space and water heating			4892.2801 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	437.6809	3.0700	1343.6803 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1019.5403 (272)
Primary energy kWh/m2/year			10.9252 (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	East
Overshading	Average or unknown
Thermal mass parameter	198.6 (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	64.34 (37)
Summer heat loss coefficient	372.29 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	2.1300	81.1852	0.4400	0.0000	0.9000	68.4781
East	4.5200	117.5071	0.4400	0.0000	0.9000	210.3283
West	3.4900	117.5071	0.4400	0.0000	0.9000	162.3995

total: 441.2058

	Jun	Jul	Aug	
Solar gains	470	441	384	(P4)
Internal gains	471	451	461	
Total summer gains	941	893	844	(P5)

Summer gain/loss ratio	2.53	2.40	2.27	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 198.6)	0.61	0.61	0.61	
Threshold temperature	19.14	20.91	20.68	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight