

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG005b			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Lockwood Corner, Plot 40				
SAP Rating	84 B	DER	18.07	TET	18.47
Environmental	85 B	% DER<TER	2.14		
CO ₂ Emissions (t/year)	1.36	DPEE	52.02	TPEE	56.04
General Requirements Compliance	Pass	% DPEE<TPEE	7.16		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 91 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) 18.47 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.07 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.0 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	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North: 3.93 m², No overhang
Windows facing East: 0.48 m², No overhang
Windows facing South: 5.16 m², No overhang
Windows facing West: 6.97 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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	0	0	0 * 40 =	0.0000 (6a)
Number of open flues	0	0	0	0 * 20 =	0.0000 (6b)
Number of intermittent fans				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1814 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4314 (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) =		0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5613	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	122.5491	122.2403	121.9376	120.5157	120.2497	119.0113	119.0113	118.7820	119.4883	120.2497	120.7879	121.3505 (39)
Average = Sum(39)m / 12 =												120.5145 (39)
HLP	1.3446	1.3412	1.3379	1.3223	1.3194	1.3058	1.3058	1.3033	1.3110	1.3194	1.3253	1.3315 (40)
HLP (average)												1.3223 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	404.1151	401.9226	387.3199	363.7104	339.6213	316.5064	301.5563	307.8118	319.9986	343.8293	371.2058	391.8504	(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	Access factor Table 6d	Gains W
North	3.9300	10.6334	0.4400	0.0000	0.7700	14.1582 (74)
East	0.4800	19.6403	0.4400	0.0000	0.7700	3.1940 (76)
South	5.1600	46.7521	0.4400	0.0000	0.7700	81.7323 (78)
West	6.9700	19.6403	0.4400	0.0000	0.7700	46.3792 (80)

Solar gains	145.4637	257.8892	376.1911	499.4832	585.7541	591.9715	566.4554	501.2305	419.1396	291.6545	176.1586	123.1938	(83)
Total gains	549.5788	659.8118	763.5110	863.1936	925.3754	908.4779	868.0117	809.0424	739.1382	635.4838	547.3644	515.0442	(84)

7. Mean internal temperature (heating season)

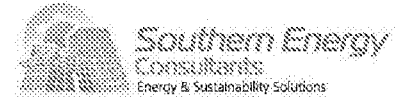
Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.7735	39.8740	39.9730	40.4446	40.5341	40.9558	40.9558	41.0349	40.7923	40.5341	40.3535	40.1664	
alpha	3.6516	3.6583	3.6649	3.6963	3.7023	3.7304	3.7304	3.7357	3.7195	3.7023	3.6902	3.6778	
util living area	0.9940	0.9877	0.9733	0.9358	0.8548	0.7143	0.5633	0.6154	0.8289	0.9581	0.9892	0.9952	(86)
MIT	19.1891	19.4100	19.7611	20.2111	20.6028	20.8628	20.9578	20.9409	20.7425	20.2213	19.6213	19.1528	(87)
Th 2	19.8060	19.8087	19.8113	19.8234	19.8257	19.8363	19.8363	19.8383	19.8322	19.8257	19.8211	19.8163	(88)
util rest of house	0.9923	0.9844	0.9656	0.9161	0.8082	0.6225	0.4315	0.4846	0.7571	0.9414	0.9856	0.9939	(89)
MIT 2	17.4108	17.7336	18.2429	18.8896	19.4183	19.7335	19.8175	19.8090	19.6091	18.9172	18.0511	17.3642	(90)
Living area fraction	17.7530	18.0562	18.5350	19.1439	19.6462	19.9508	20.0369	20.0269	19.8272	19.1682	18.3533	17.7084	(91)
MIT	17.7530	18.0562	18.5350	19.1439	19.6462	19.9508	20.0369	20.0269	19.8272	19.1682	18.3533	17.7084	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.6030	17.9062	18.3850	18.9939	19.4962	19.8008	19.8869	19.8769	19.6772	19.0182	18.2033	17.5584	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9874	0.9762	0.9524	0.8979	0.7924	0.6193	0.4377	0.4893	0.7455	0.9252	0.9780	0.9899	(94)
Ext temp.	542.6627	644.0865	727.1841	775.0659	733.2942	562.6566	379.9310	395.8846	551.0467	587.9602	535.3193	509.8383	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1630.2725	1589.8795	1449.2326	1216.4791	937.4950	618.9576	391.1788	412.9910	666.4090	1012.2827	1341.1429	1621.0523	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m ²	809.1817	635.5729	537.2041	317.8175	151.9254	0.0000	0.0000	0.0000	0.0000	315.6959	580.1930	826.7432	(98)
												4174.3337	(98)
												(98) / (4) =	45.8013 (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													4612.5234 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	809.1817	635.5729	537.2041	317.8175	151.9254	0.0000	0.0000	0.0000	0.0000	315.6959	580.1930	826.7432	(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)	894.1235	702.2905	593.5957	351.1795	167.8734	0.0000	0.0000	0.0000	0.0000	348.8353	641.0972	913.5284	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)
Efficiency of water heater (217)m	89.9215	89.8675	89.7567	89.5067	88.9752	87.3000	87.3000	87.3000	87.3000	89.4764	89.8072	89.9453	(217)
Fuel for water heating, kWh/month	191.5502	168.0698	174.6842	154.1806	149.9154	133.4888	125.3239	141.4982	142.5034	160.0830	172.2067	185.9397	(219)
Water heating fuel used												1899.4442	(219)
Annual totals kWh/year													
Space heating fuel - main system												4612.5234	(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)												387.2964	(232)
Total delivered energy for all uses												6974.2640	(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	4612.5234	0.2160	996.3051 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1899.4442	0.2160	410.2799 (264)
Space and water heating			1406.5850 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total CO2, kg/year			1646.5168 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.0700 (273)

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

DER		18.0700 ZC1
Total Floor Area	TFA	91.1400
Assumed number of occupants	N	2.6410
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.6798 ZC2
CO2 emissions from cooking, equation (L16)		2.0011 ZC3
Total CO2 emissions		35.7510 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		35.7510 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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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) =	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (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)			16.5400	1.3258	21.9280		(27)					
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)					
Brick Cavity	132.7600	20.8400	111.9200	0.1800	20.1456		(29a)					
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)					
Total net area of external elements Aum(A, m2)			223.9000				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6518		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1552 (36)					
Total fabric heat loss						(33) + (36) =	69.8070 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 42.7614	Feb 42.5140	Mar 42.2716	Apr 41.1330	May 40.9199	Jun 39.9282	Jul 39.9282	Aug 39.7445	Sep 40.3102	Oct 40.9199	Nov 41.3509	Dec 41.8015 (38)
Heat transfer coeff	112.5684	112.3211	112.0786	110.9400	110.7269	109.7352	109.7352	109.5515	110.1172	110.7269	111.1579	111.6085 (39)
Average = Sum(39)m / 12 =												110.9390 (39)
HLP	Jan 1.2351	Feb 1.2324	Mar 1.2297	Apr 1.2172	May 1.2149	Jun 1.2040	Jul 1.2040	Aug 1.2020	Sep 1.2082	Oct 1.2149	Nov 1.2196	Dec 1.2246 (40)
HLP (average)												1.2172 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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)

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.3792	46.8421	46.4279	43.0183	44.4522	46.4279	46.8421	50.3792	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (64)
Heat gains from water heating, kWh/month	65.3109	57.4859	60.0411	53.0754	51.2975	45.0045	42.8506	48.0263	48.5648	55.5449	59.2122	63.6521 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4763	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	87.7835	85.5446	80.7004	73.7158	68.9483	62.5062	57.5949	64.5515	67.4512	74.6572	82.2392	85.5539 (72)
Total internal gains	416.4883	414.2999	399.5121	375.2541	350.5118	326.7459	311.8035	318.7096	331.5529	356.0323	383.5891	404.2277 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	3.9300	10.6334	0.6300		0.7000	0.7700	12.7713 (74)
East	0.4800	19.6403	0.6300		0.7000	0.7700	2.8811 (76)
South	5.1600	46.7521	0.6300		0.7000	0.7700	73.7263 (78)
West	6.9700	19.6403	0.6300		0.7000	0.7700	41.8362 (80)

Solar gains	131.2149	232.6278	339.3415	450.5566	528.3768	533.9852	510.9685	452.1327	378.0830	263.0856	158.9031	111.1264 (83)
Total gains	547.7032	646.9277	738.8536	825.8106	878.8886	860.7311	822.7721	770.8423	709.6359	619.1180	542.4922	515.3541 (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	56.2251	56.3489	56.4708	57.0504	57.1601	57.6767	57.6767	57.7734	57.4766	57.1601	56.9385	56.7087
alpha	4.7483	4.7566	4.7647	4.8034	4.8107	4.8451	4.8451	4.8516	4.8318	4.8107	4.7959	4.7806
util living area	0.9980	0.9952	0.9871	0.9603	0.8864	0.7353	0.5677	0.6223	0.8555	0.9760	0.9957	0.9985 (86)
MIT	19.6471	19.8177	20.0901	20.4408	20.7446	20.9292	20.9839	20.9753	20.8443	20.4426	19.9774	19.6169 (87)
Th 2	19.8920	19.8942	19.8963	19.9062	19.9081	19.9168	19.9168	19.9184	19.9134	19.9081	19.9043	19.9004 (88)
util rest of house	0.9973	0.9935	0.9824	0.9448	0.8415	0.6408	0.4376	0.4912	0.7832	0.9637	0.9939	0.9980 (89)
MIT 2	18.0952	18.3456	18.7425	19.2490	19.6556	19.8692	19.9109	19.9082	19.7875	19.2607	18.5867	18.0570 (90)
Living area fraction									fLA = Living area / (4) =			0.1925 (91)
MIT	18.3939	18.6289	19.0018	19.4784	19.8652	20.0732	20.1174	20.1136	19.9909	19.4882	18.8543	18.3572 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3939	18.6289	19.0018	19.4784	19.8652	20.0732	20.1174	20.1136	19.9909	19.4882	18.8543	18.3572 (93)

8. Space heating requirement

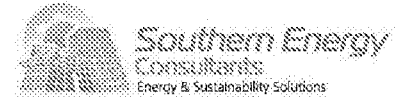
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9958	0.9906	0.9770	0.9370	0.8394	0.6558	0.4627	0.5163	0.7893	0.9572	0.9913	0.9968 (94)
Useful gains	545.4000	640.8577	721.8776	773.8049	737.7374	564.4405	380.6839	397.9691	560.1320	592.6254	537.7795	513.7126 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1586.5258	1542.0439	1401.1871	1173.5662	904.1039	600.6011	385.9824	406.8293	648.6849	984.1618	1306.5873	1580.0624 (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	774.5976	605.5972	505.4063	287.8281	123.7767	0.0000	0.0000	0.0000	0.0000	291.3030	553.5416	793.3643 (98)
Space heating												3935.4148 (98)
Space heating per m2										(98) / (4) =		43.1799 (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												4213.5062 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	774.5976	605.5972	505.4063	287.8281	123.7767	0.0000	0.0000	0.0000	0.0000	291.3030	553.5416	793.3643 (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)	829.3336	648.3910	541.1203	308.1671	132.5232	0.0000	0.0000	0.0000	0.0000	311.8876	592.6570	849.4265 (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	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (64)
Efficiency of water heater (217)m	88.0463	87.8226	87.3626	86.3486	84.3272	80.3000	80.3000	80.3000	80.3000	86.2626	87.5816	80.3000 (216)
Fuel for water heating, kWh/month	237.4521	209.8667	221.0040	198.3212	196.6127	181.8500	174.2262	194.2213	196.3663	208.1466	217.3036	231.5605 (219)
Water heating fuel used												2466.9313 (219)
Annual totals kWh/year												
Space heating fuel - main system												4213.5062 (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)												387.2964 (232)
Total delivered energy for all uses												7142.7339 (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	4213.5062	0.2160	910.1173 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2466.9313	0.2160	532.8572 (264)
Space and water heating			1442.9745 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total CO2, kg/m2/year			1682.9063 (272)
Emissions per m2 for space and water heating			15.8325 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2055 (272b)
Emissions per m2 for pumps and fans			0.4271 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8325 * 1.00) + 2.2055 + 0.4271, rounded to 2 d.p.			18.4700 (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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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)	=	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			9.0000	410.1300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17137.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 188.0296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	42.7614	42.5140	42.2716	41.1330	40.9199	39.9282	39.9282	39.7445	40.3102	40.9199	41.3509	41.8015 (38)
Heat transfer coeff	120.9651	120.7178	120.4754	119.3367	119.1237	118.1319	118.1319	117.9483	118.5139	119.1237	119.5546	120.0052 (39)
Average = Sum(39)m / 12 =												119.3357 (39)
HLP	1.3272	1.3245	1.3219	1.3094	1.3070	1.2962	1.2962	1.2941	1.3004	1.3070	1.3118	1.3167 (40)
HLP (average)												1.3094 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.5981	29.3851	30.3228	26.4362	25.3661	21.8890	20.2834	23.2755	23.5535	27.4493	29.9631	32.5380 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	45.1588	43.7279	40.7565	36.7169	34.0943	30.4015	27.2627	31.2843	32.7132	36.8943	41.6154	43.7339	(72)
Total internal gains	370.8636	369.4832	356.5682	335.2552	312.6578	291.6411	278.4713	282.4424	293.8150	315.2694	339.9653	359.4076	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9300	10.6334	0.4400		0.0000	0.7700	14.1582 (74)
East	0.4800	19.6403	0.4400		0.0000	0.7700	3.1940 (76)
South	5.1600	46.7521	0.4400		0.0000	0.7700	81.7323 (78)
West	6.9700	19.6403	0.4400		0.0000	0.7700	46.3792 (80)

Solar gains	145.4637	257.8892	376.1911	499.4832	585.7541	591.9715	566.4554	501.2305	419.1396	291.6545	176.1586	123.1938	(83)
Total gains	516.3274	627.3725	732.7593	834.7384	898.4119	883.6126	844.9267	783.6730	712.9546	606.9239	516.1239	462.6015	(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	39.3525	39.4332	39.5125	39.8895	39.9609	40.2963	40.2963	40.3591	40.1664	39.9609	39.8168	39.6673	
alpha	3.6235	3.6289	3.6342	3.6593	3.6641	3.6864	3.6864	3.6906	3.6778	3.6641	3.6545	3.6445	
util living area	0.9947	0.9888	0.9749	0.9384	0.8593	0.7215	0.5712	0.6256	0.8366	0.9613	0.9903	0.9958	(86)
MIT	19.1438	19.3686	19.7263	20.1828	20.5844	20.8530	20.9539	20.9351	20.7257	20.1888	19.5774	19.1037	(87)
Th 2	19.8196	19.8217	19.8237	19.8335	19.8353	19.8438	19.8438	19.8454	19.8406	19.8353	19.8316	19.8278	(88)
util rest of house	0.9932	0.9857	0.9677	0.9197	0.8143	0.6313	0.4398	0.4954	0.7674	0.9459	0.9872	0.9947	(89)
MIT 2	18.1383	18.3633	18.7183	19.1692	19.5414	19.7673	19.8294	19.8229	19.6755	19.1843	18.5798	18.1045	(90)
Living area fraction										FLA = Living area / (4) =		0.1925	(91)
MIT	18.3318	18.5568	18.9123	19.3643	19.7421	19.9763	20.0458	20.0369	19.8776	19.3776	18.7718	18.2968	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3318	18.5568	18.9123	19.3643	19.7421	19.9763	20.0458	20.0369	19.8776	19.3776	18.7718	18.2968	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	511.4925	615.5728	703.7246	759.8987	727.7780	567.9456	392.2896	406.6433	549.0203	569.2438	507.4562	479.0227	(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	1697.3609	1648.6172	1495.3791	1248.7717	958.0037	635.1089	407.0604	428.9688	684.7266	1045.6219	1395.4131	1691.6939	(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	882.2861	694.2058	588.9909	351.9886	171.2880	0.0000	0.0000	0.0000	0.0000	354.4254	639.3290	902.2274	(98)
Space heating												4584.7411	(98)
Space heating per m2										(98) / (4) =		50.3044	(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	1110.4400	874.1762	896.4068	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

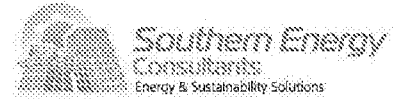


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7944	0.8625	0.8329	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	882.0831	753.9725	746.6603	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1132.7027	1085.3822	1015.5619	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	180.4461	246.5688	200.0628	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												627.0778 (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	45.1115	61.6422	50.0157	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												156.7694 (107)
Space cooling per m2												1.7201 (108)
Energy for space heating												50.3044 (99)
Energy for space cooling												1.7201 (108)
Total												52.0245 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.0 (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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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) =	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (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)			16.5400	1.3258	21.9280			(27)					
Heat Loss Floor 1			45.5700	0.1300	5.9241			(28a)					
Brick Cavity	132.7600	20.8400	111.9200	0.1800	20.1456			(29a)					
Main Plane	45.5700		45.5700	0.1300	5.9241			(30)					
Total net area of external elements Aum(A, m2)			223.9000					(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6518			(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								11.1552 (36)					
Total fabric heat loss						(33) + (36) =		69.8070 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)													
(38)m	Jan 42.7614	Feb 42.5140	Mar 42.2716	Apr 41.1330	May 40.9199	Jun 39.9282	Jul 39.9282	Aug 39.7445	Sep 40.3102	Oct 40.9199	Nov 41.3509	Dec 41.8015	(38)
Heat transfer coeff	112.5684	112.3211	112.0786	110.9400	110.7269	109.7352	109.7352	109.5515	110.1172	110.7269	111.1579	111.6085	(39)
Average = Sum(39)m / 12 =												110.9390	(39)
HLP	Jan 1.2351	Feb 1.2324	Mar 1.2297	Apr 1.2172	May 1.2149	Jun 1.2040	Jul 1.2040	Aug 1.2020	Sep 1.2082	Oct 1.2149	Nov 1.2196	Dec 1.2246	(40)
HLP (average)												1.2172	(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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	Jan 106.6163	Feb 102.7393	Mar 98.8623	Apr 94.9854	May 91.1084	Jun 87.2315	Jul 87.2315	Aug 91.1084	Sep 94.9854	Oct 98.8623	Nov 102.7393	Dec 106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)												Total = Sum(45)m = 1524.9898 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.5981	29.3851	30.3228	26.4362	25.3661	21.8890	20.2834	23.2755	23.5535	27.4493	29.9631	32.5380 (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	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	45.1588	43.7279	40.7565	36.7169	34.0943	30.4015	27.2627	31.2843	32.7132	36.8943	41.6154	43.7339	(72)
Total internal gains	370.8636	369.4832	356.5682	335.2552	312.6578	291.6411	278.4713	282.4424	293.8150	315.2694	339.9653	359.4076	(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	3.9300	10.6334	0.6300	0.7000	0.7700	12.7713	(74)
East	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(76)
South	5.1600	46.7521	0.6300	0.7000	0.7700	73.7263	(78)
West	6.9700	19.6403	0.6300	0.7000	0.7700	41.8362	(80)

Solar gains	131.2149	232.6278	339.3415	450.5566	528.3768	533.9852	510.9685	452.1327	378.0830	263.0856	158.9031	111.1264	(83)
Total gains	502.0785	602.1110	695.9097	785.8118	841.0346	825.6263	789.4398	734.5751	671.8980	578.3551	498.8684	470.5341	(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	56.2251	56.3489	56.4708	57.0504	57.1601	57.6767	57.6767	57.7734	57.4766	57.1601	56.9385	56.7087	
alpha	4.7483	4.7566	4.7647	4.8034	4.8107	4.8451	4.8451	4.8516	4.8318	4.8107	4.7959	4.7806	
util living area	0.9986	0.9964	0.9899	0.9669	0.8999	0.7558	0.5884	0.6471	0.8752	0.9815	0.9970	0.9990	(86)
MIT	19.6012	19.7732	20.0490	20.4069	20.7221	20.9201	20.9813	20.9708	20.8249	20.4054	19.9339	19.5716	(87)
Th 2	19.8920	19.8942	19.8963	19.9062	19.9081	19.9168	19.9168	19.9184	19.9134	19.9081	19.9043	19.9004	(88)
util rest of house	0.9981	0.9952	0.9861	0.9535	0.8584	0.6623	0.4551	0.5135	0.8079	0.9718	0.9957	0.9986	(89)
MIT 2	18.6195	18.7927	19.0683	19.4260	19.7177	19.8794	19.9120	19.9100	19.8142	19.4308	18.9615	18.5966	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.8084	18.9814	19.2570	19.6148	19.9110	20.0797	20.1178	20.1142	20.0087	19.6184	19.1486	18.7843	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8084	18.9814	19.2570	19.6148	19.9110	20.0797	20.1178	20.1142	20.0087	19.6184	19.1486	18.7843	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9974	0.9937	0.9831	0.9490	0.8585	0.6778	0.4811	0.5394	0.8149	0.9683	0.9945	0.9981	(94)
Ext temp.	500.7923	598.3248	684.1666	745.7037	722.0174	559.6134	379.7701	396.2240	547.5594	559.9968	496.1135	469.6468	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1633.1913	1581.6369	1429.7884	1188.6943	909.1783	601.3127	386.0268	406.8928	650.6474	998.5780	1339.3012	1627.7287	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating per m ²	842.5049	660.7857	554.7427	318.9532	139.2477	0.0000	0.0000	0.0000	0.0000	326.3044	607.0951	861.6130	(98)
												4311.2466	(98)
											(98) / (4) =	47.3036	(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	1031.5109	812.0405	832.5918	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8419	0.9084	0.8817	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	868.3828	737.6568	734.1106	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1064.9265	1020.5274	958.1749	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

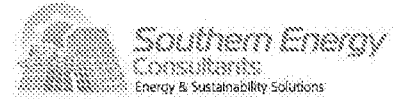


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	141.5114	210.4557	166.7039	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												518.6710 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	35.3779	52.6139	41.6760	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												129.6678 (107)
Space cooling per m2												1.4227 (108)
Energy for space heating												47.3036 (99)
Energy for space cooling												1.4227 (108)
Total												48.7263 (109)
Target Fabric Energy Efficiency (TFEE)												56.0 (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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	119.9898	119.4883	119.4883	118.7820	118.7820	117.9258	118.1307	117.7271	117.9258	118.3417	118.3417	119.0113 (39)
Average = Sum(39)m / 12 =												118.6612 (39)
HLP	1.3165	1.3110	1.3110	1.3033	1.3033	1.2939	1.2961	1.2917	1.2939	1.2985	1.2985	1.3058 (40)
HLP (average)												1.3020 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Calculation of Heat Demand 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
												1690 (64)
												1690 (64)
												1690 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(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					3.9300	11.9814	0.4400	0.0000	0.7700		15.9531 (74)	
East					0.4800	22.3313	0.4400	0.0000	0.7700		3.6316 (76)	
South					5.1600	50.9848	0.4400	0.0000	0.7700		89.1321 (78)	
West					6.9700	22.3313	0.4400	0.0000	0.7700		52.7340 (80)	

Solar gains	161.4508	257.8650	372.5663	511.7584	586.4964	635.1253	600.8511	542.3625	450.6128	311.6373	200.3604	135.3821 (83)
Total gains	760.9334	852.7097	944.2460	1047.4439	1085.2039	1100.7786	1047.2276	997.4400	926.4393	823.6794	752.6678	718.2734 (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	40.6219	40.7923	40.7923	41.0349	41.0349	41.3328	41.2611	41.4026	41.3328	41.1876	41.1876	40.9558	
alpha	3.7081	3.7195	3.7195	3.7357	3.7357	3.7555	3.7507	3.7602	3.7555	3.7458	3.7458	3.7304	
util living area	0.9798	0.9685	0.9397	0.8689	0.7336	0.5105	0.3452	0.3716	0.6573	0.8892	0.9637	0.9831	(86)
MIT	19.5887	19.7669	20.1032	20.5027	20.8123	20.9662	20.9943	20.9926	20.9085	20.5367	20.0088	19.5563	(87)
Th 2	19.8279	19.8322	19.8322	19.8383	19.8383	19.8456	19.8439	19.8473	19.8456	19.8420	19.8420	19.8363	(88)
util rest of house	0.9745	0.9602	0.9234	0.8332	0.6630	0.4032	0.2187	0.2408	0.5547	0.8503	0.9524	0.9786	(89)
MIT 2	18.0037	18.2621	18.7397	19.2894	19.6728	19.8283	19.8428	19.8458	19.7850	19.3511	18.6198	17.9629	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.3087	18.5517	19.0021	19.5229	19.8921	20.0473	20.0644	20.0665	20.0012	19.5793	18.8871	18.2696	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1587	18.4017	18.8521	19.3729	19.7421	19.8973	19.9144	19.9165	19.8512	19.4293	18.7371	18.1196	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9635	0.9462	0.9056	0.8161	0.6565	0.4082	0.2266	0.2488	0.5553	0.8330	0.9375	0.9687	(94)
Useful gains	733.1285	806.8698	855.1413	854.8391	712.4320	449.3606	237.2512	248.1486	514.4304	686.1612	705.5935	695.7909	(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	1566.9156	1529.6489	1368.3914	1125.2121	800.8431	459.5926	237.9611	249.1652	548.4989	926.5287	1270.6463	1549.4746	(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	620.3376	485.7075	381.8580	194.6686	65.7779	0.0000	0.0000	0.0000	0.0000	178.8334	406.8380	635.1407	(98)
Space heating												2969.1618	(98)
RHI space heating demand												2969	(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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5813	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	122.5491	122.2403	121.9376	120.5157	120.2497	119.0113	119.0113	118.7820	119.4883	120.2497	120.7879	121.3505 (39)
Average = Sum(39)m / 12 =												120.5145 (39)
HLP	1.3446	1.3412	1.3379	1.3223	1.3194	1.3058	1.3058	1.3033	1.3110	1.3194	1.3253	1.3315 (40)
HLP (average)												1.3223 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9300	10.6334	0.4400	0.0000	0.7700	14.1582 (74)
East	0.4800	19.6403	0.4400	0.0000	0.7700	3.1940 (76)
South	5.1600	46.7521	0.4400	0.0000	0.7700	81.7323 (78)
West	6.9700	19.6403	0.4400	0.0000	0.7700	46.3792 (80)

Solar gains	145.4637	257.8892	376.1911	499.4832	585.7541	591.9715	566.4554	501.2305	419.1396	291.6545	176.1586	123.1938 (83)
Total gains	744.9464	852.7339	947.8709	1035.1687	1084.4616	1057.6247	1012.8319	956.3080	894.9661	803.6966	728.4660	706.0852 (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	39.7735	39.8740	39.9730	40.4446	40.5341	40.9558	40.9558	41.0349	40.7923	40.5341	40.3535	40.1664
alpha	3.6516	3.6583	3.6649	3.6963	3.7023	3.7304	3.7304	3.7357	3.7195	3.7023	3.6902	3.6778
util living area	0.9840	0.9729	0.9501	0.8978	0.7993	0.6450	0.4947	0.5388	0.7547	0.9205	0.9735	0.9867 (86)
MIT	19.4145	19.6248	19.9513	20.3586	20.6947	20.9033	20.9725	20.9621	20.8188	20.3802	19.8246	19.3756 (87)
Th 2	19.8060	19.8087	19.8113	19.8234	19.8257	19.8363	19.8363	19.8383	19.8322	19.8257	19.8211	19.8163 (88)
util rest of house	0.9798	0.9659	0.9369	0.8701	0.7445	0.5526	0.3738	0.4167	0.6727	0.8929	0.9655	0.9832 (89)
MIT 2	17.7371	18.0418	18.5099	19.0849	19.5240	19.7672	19.8246	19.8206	19.6846	19.1294	18.3419	17.6874 (90)
Living area fraction									fLA = Living area / (4) =			0.1925 (91)
MIT	18.0599	18.3464	18.7873	19.3301	19.7493	19.9858	20.0455	20.0402	19.9029	19.3701	18.6273	18.0123 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9099	18.1964	18.6373	19.1801	19.5993	19.8358	19.8955	19.8902	19.7529	19.2201	18.4773	17.8623 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9701	0.9528	0.9197	0.8515	0.7324	0.5525	0.3803	0.4225	0.6663	0.8745	0.9524	0.9747 (94)
Ext temp.	722.6989	812.4535	871.7757	881.4159	794.2354	584.3759	385.1471	404.0307	596.3124	702.8191	693.7990	688.1970 (95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Month fracti	1667.8810	1625.3583	1479.9951	1238.9091	949.8931	623.1238	392.2056	414.5783	675.4501	1036.5654	1374.2361	1657.9286 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	703.2155	546.2720	452.5153	257.3951	115.8093	0.0000	0.0000	0.0000	0.0000	248.3072	489.9147	721.4803 (98)
												3534.9094 (98)
										(98) / (4) =		38.7855 (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													3905.9772	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	703.2155	546.2720	452.5153	257.3951	115.8093	0.0000	0.0000	0.0000	0.0000	248.3072	489.9147	721.4803	(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)	777.0337	603.6154	500.0169	284.4145	127.9661	0.0000	0.0000	0.0000	0.0000	274.3726	541.3422	797.2158	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)	
Efficiency of water heater (217)m	89.8520	89.7871	89.6543	89.3568	88.7585	87.3000	87.3000	87.3000	87.3000	89.3025	89.7110	89.8800	(216)	
Fuel for water heating, kWh/month	191.6984	168.2203	174.8836	154.4392	150.2815	133.4888	125.3239	141.4982	142.5034	160.3946	172.3914	186.0747	(219)	
Water heating fuel used												1901.1982	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3905.9772	(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)													387.2964	(232)
Total delivered energy for all uses													6269.4718	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3905.9772	3.4800	135.9280 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1901.1982	3.4800	66.1617 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	387.2964	13.1900	51.0844 (250)
Additional standing charges			120.0000 (251)
Total energy cost			383.0666 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.1818 (257)
SAP value	83.5141
SAP rating (Section 12)	84 (258)
SAP band	B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3905.9772	0.2160	843.6911 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1901.1982	0.2160	410.6588 (264)
Space and water heating			1254.3499 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total kg/year			1494.2817 (272)
CO2 emissions per m2			16.4000 (273)
EI value			85.2921
EI rating			85 (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	$3.48 / 0.8879 = 3.919$, stars = 4
Water heating environmental impact	$0.216 / 0.8879 = 0.2433$, stars = 4

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

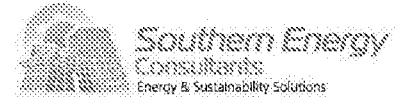
Calculation Type: New Build (As Designed)



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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	119.9898	119.4883	119.4883	118.7820	118.7820	117.9258	118.1307	117.7271	117.9258	118.3417	118.3417	119.0113 (39)
Average = Sum(39)m / 12 =												118.6612 (39)
HLP	1.3165	1.3110	1.3110	1.3033	1.3033	1.2939	1.2961	1.2917	1.2939	1.2985	1.2985	1.3058 (40)
HLP (average)												1.3020 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870 (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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9300	11.9814	0.4400	0.0000	0.7700	15.9531 (74)
East	0.4800	22.3313	0.4400	0.0000	0.7700	3.6316 (76)
South	5.1600	50.9848	0.4400	0.0000	0.7700	89.1321 (78)
West	6.9700	22.3313	0.4400	0.0000	0.7700	52.7340 (80)

Solar gains	161.4508	257.8650	372.5663	511.7584	586.4964	635.1253	600.8511	542.3625	450.6128	311.6373	200.3604	135.3821 (83)
Total gains	760.9334	852.7097	944.2460	1047.4439	1085.2039	1100.7786	1047.2276	997.4400	926.4393	823.6794	752.6678	718.2734 (84)

7. Mean internal temperature (heating season)

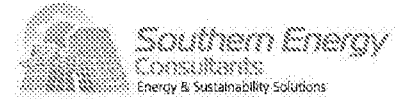
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.6219	40.7923	40.7923	41.0349	41.0349	41.3328	41.2611	41.4026	41.3328	41.1876	41.1876	40.9558
alpha	3.7081	3.7195	3.7195	3.7357	3.7357	3.7555	3.7507	3.7602	3.7555	3.7458	3.7458	3.7304
util living area	0.9798	0.9685	0.9397	0.8689	0.7336	0.5105	0.3452	0.3716	0.6573	0.8892	0.9637	0.9831 (86)
MIT	19.5887	19.7669	20.1032	20.5027	20.8123	20.9662	20.9943	20.9926	20.9085	20.5367	20.0088	19.5563 (87)
Th 2	19.8279	19.8322	19.8322	19.8383	19.8383	19.8456	19.8439	19.8473	19.8456	19.8420	19.8420	19.8363 (88)
util rest of house	0.9745	0.9602	0.9234	0.8332	0.6630	0.4032	0.2187	0.2408	0.5547	0.8503	0.9524	0.9786 (89)
MIT 2	18.0037	18.2621	18.7397	19.2894	19.6728	19.8283	19.8428	19.8458	19.7850	19.3511	18.6198	17.9629 (90)
Living area fraction	18.3087	18.5517	19.0021	19.5229	19.8921	20.0473	20.0644	20.0665	20.0012	19.5793	18.8871	18.2696 (92)
MIT	18.1587	18.4017	18.8521	19.3729	19.7421	19.8973	19.9144	19.9165	19.8512	19.4293	18.7371	18.1196 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.1196 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9635	0.9462	0.9056	0.8161	0.6565	0.4082	0.2266	0.2488	0.5553	0.8330	0.9375	0.9687 (94)
Ext temp.	733.1285	806.8698	855.1413	854.8391	712.4320	449.3606	237.2512	248.1486	514.4304	686.1612	705.5935	695.7909 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1566.9156	1529.6489	1368.3914	1125.2121	800.8431	459.5926	237.9611	249.1652	548.4989	926.5287	1270.6463	1549.4746 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	620.3376	485.7075	381.8580	194.6686	65.7779	0.0000	0.0000	0.0000	0.0000	178.8334	406.8380	635.1407 (98)
												2969.1618 (98)
												32.5780 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3280.8418	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	620.3376	485.7075	381.8580	194.6686	65.7779	0.0000	0.0000	0.0000	0.0000	178.8334	406.8380	635.1407	(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)	685.4560	536.6934	421.9426	215.1034	72.6827	0.0000	0.0000	0.0000	0.0000	197.6060	449.5448	701.8129	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)	
Efficiency of water heater (217)m	89.7848	89.7199	89.5446	89.1445	88.3315	87.3000	87.3000	87.3000	87.3000	89.0483	89.5954	89.8138	(217)	
Fuel for water heating, kWh/month	191.8419	168.3463	175.0980	154.8070	151.0080	133.4888	125.3239	141.4982	142.5034	160.8524	172.6138	186.2119	(219)	
Water heating fuel used												1903.5937	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3280.8418	(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)													387.2964	(232)
Total delivered energy for all uses													5646.7319	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3280.8418	3.8700	126.9686 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1903.5937	3.8700	73.6691 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	387.2964	18.9000	73.1990 (250)
Additional standing charges			93.0000 (251)
Total energy cost			381.0117 (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	3280.8418	0.2160	708.6618 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.5937	0.2160	411.1762 (264)
Space and water heating			1119.8381 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total kg/year			1359.7699 (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	3280.8418	1.2200	4002.6270 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.5937	1.2200	2322.3843 (264)
Space and water heating			6325.0113 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	387.2964	3.0700	1189.0000 (268)
Primary energy kWh/year			7744.2613 (272)
Primary energy kWh/m2/year			84.9710 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 85

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 (13.7%)
U Solar photovoltaic panels	+ 9.8	-£ 345	-947 kg (80.7%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.05 kg/m²	B 85 B 87
Solar photovoltaic panels	£345	10.39 kg/m²	A 94 A 96
Total Savings	£373	12.44 kg/m²	

Potential energy efficiency rating: A 94
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	£87	£97	-£9
Mains gas	£294	£256	£38
Space heating	£234	£234	£0
Water heating	£74	£45	£29
Lighting	£73	£73	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£381	£8	£374
Total cost of uses	£381	£7	£374
Delivered energy	62 kWh/m²	32 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	2 kg/m²	12 kg/m²
Primary energy	85 kWh/m²	12 kWh/m²	73 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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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) =	0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5613	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 78.2037 (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	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	122.5491	122.2403	121.9376	120.5157	120.2497	119.0113	119.0113	118.7820	119.4883	120.2497	120.7879	121.3505 (39)
Average = Sum(39)m / 12 =												120.5145 (39)
HLP	1.3446	1.3412	1.3379	1.3223	1.3194	1.3058	1.3058	1.3033	1.3110	1.3194	1.3253	1.3315 (40)
HLP (average)												1.3223 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

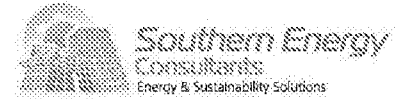
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1893 (H8)
Utilisation factor												0.5687 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.9239 (H14)
Volume ratio Veff/V												0.7738 (H15)
Solar storage volume factor												0.9487 (H16)
Solar input												-860.3285 (H17)
Solar input	-24.9478	-41.6307	-70.9019	-95.0225	-117.3923	-115.4153	-113.8901	-99.5063	-77.9334	-53.2193	-29.5917	-20.8771 (63)
Solar input (sum of months) = Sum(63)m =												-860.3285 (63)
Output from w/h	147.2970	109.4094	85.8889	42.9794	15.9953	1.1204	0.0000	24.0216	46.4721	90.0171	125.0623	146.3669 (64)
Total per year (kWh/year) = Sum(64)m =												834.6306 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(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	3.9300	10.6334	0.4400	0.0000	0.7700	14.1582 (74)
East	0.4800	19.6403	0.4400	0.0000	0.7700	3.1940 (76)
South	5.1600	46.7521	0.4400	0.0000	0.7700	81.7323 (78)
West	6.9700	19.6403	0.4400	0.0000	0.7700	46.3792 (80)

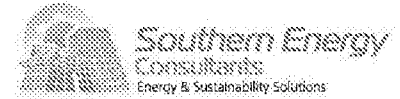
Solar gains	145.4637	257.8892	376.1911	499.4832	585.7541	591.9715	566.4554	501.2305	419.1396	291.6545	176.1586	123.1938 (83)
Total gains	744.9464	852.7339	947.8709	1035.1687	1084.4616	1057.6247	1012.8319	956.3080	894.9661	803.6966	728.4660	706.0852 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	39.7735	39.8740	39.9730	40.4446	40.5341	40.9558	40.9558	41.0349	40.7923	40.5341	Nov 3535	Dec 1664
alpha	3.6516	3.6583	3.6649	3.6963	3.7023	3.7304	3.7304	3.7357	3.7195	3.7023	3.6902	3.6778
util living area	0.9840	0.9729	0.9501	0.8978	0.7993	0.6450	0.4947	0.5388	0.7547	0.9205	0.9735	0.9867 (86)
MIT	19.4145	19.6248	19.9513	20.3586	20.6947	20.9033	20.9725	20.9621	20.8188	20.3802	19.8246	19.3756 (87)
Th 2	19.8060	19.8087	19.8113	19.8234	19.8257	19.8363	19.8363	19.8383	19.8322	19.8257	19.8211	19.8163 (88)
util rest of house	0.9798	0.9659	0.9369	0.8701	0.7445	0.5526	0.3738	0.4167	0.6727	0.8929	0.9655	0.9832 (89)
MIT 2	17.7371	18.0418	18.5099	19.0849	19.5240	19.7672	19.8246	19.8206	19.6846	19.1294	18.3419	17.6874 (90)
Living area fraction									fLA = Living area / (4) =			0.1925 (91)
MIT	18.0599	18.3464	18.7873	19.3301	19.7493	19.9858	20.0455	20.0402	19.9029	19.3701	18.6273	18.0123 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9099	18.1964	18.6373	19.1801	19.5993	19.8358	19.8955	19.8902	19.7529	19.2201	18.4773	17.8623 (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	0.9701	0.9528	0.9197	0.8515	0.7324	0.5525	0.3803	0.4225	0.6663	0.8745	0.9524	0.9747	(94)
Useful gains	722.6989	812.4535	871.7757	881.4159	794.2354	584.3759	385.1471	404.0307	596.3124	702.8191	693.7990	688.1970	(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	1667.8810	1625.3583	1479.9951	1238.9091	949.8931	623.1238	392.2056	414.5783	675.4501	1036.5654	1374.2361	1657.9286	(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	703.2155	546.2720	452.5153	257.3951	115.8093	0.0000	0.0000	0.0000	0.0000	248.3072	489.9147	721.4803	(98)
Space heating												3534.9094	(98)
Space heating per m2											(98) / (4) =	38.7855	(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													3905.9772 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	703.2155	546.2720	452.5153	257.3951	115.8093	0.0000	0.0000	0.0000	0.0000	248.3072	489.9147	721.4803	(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)	777.0337	603.6154	500.0169	284.4145	127.9661	0.0000	0.0000	0.0000	0.0000	274.3726	541.3422	797.2158	(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	147.2970	109.4094	85.8889	42.9794	15.9953	1.1204	0.0000	24.0216	46.4721	90.0171	125.0623	146.3669	(64)
Efficiency of water heater	89.9291	89.9498	89.9739	90.0278	90.0992	87.3000	87.3000	87.3000	87.3000	89.6259	89.8304	89.9440	(217)
Fuel for water heating, kWh/month	163.7924	121.6338	95.4598	47.7402	17.7530	1.2834	0.0000	27.5162	53.2326	100.4365	139.2205	162.7313	(219)
Water heating fuel used												930.7997	(219)
Annual totals kWh/year													
Space heating fuel - main system												3905.9772	(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)													387.2964 (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												3621.8339	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3905.9772	3.4800	135.9280	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	930.7997	3.4800	32.3918	(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	387.2964	13.1900	51.0844	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			128.0689	(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] =	0.3951 (257)
SAP value		94.4884
SAP rating (Section 12)		94 (258)
SAP band		A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3905.9772	0.2160	843.6911 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	930.7997	0.2160	201.0527 (264)
Space and water heating			1044.7438 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			414.1884 (272)
CO2 emissions per m2			4.5400 (273)
EI value			95.9232
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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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) =		0.3667 (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	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick Cavity	132.7600	20.8400	111.9200	0.2500	27.9800	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		68.9959		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
 Total fabric heat loss (33) + (36) = 78.2037 (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	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	119.9898	119.4883	119.4883	118.7820	118.7820	117.9258	118.1307	117.7271	117.9258	118.3417	118.3417	119.0113 (39)
Average = Sum(39)m / 12 =												118.6612 (39)
HLP	1.3165	1.3110	1.3110	1.3033	1.3033	1.2939	1.2961	1.2917	1.2939	1.2985	1.2985	1.3058 (40)
HLP (average)												1.3020 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (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												1.2560 (H8)
Utilisation factor												0.5490 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.9239 (H14)
Volume ratio Veff/V												0.7738 (H15)
Solar storage volume factor												0.9487 (H16)
Solar input												-877.1154 (H17)
Solar input	-26.9972	-40.5767	-68.3363	-94.4617	-113.7636	-119.7313	-116.8563	-104.3534	-81.4482	-55.4077	-32.8158	-22.3673 (63)
Solar input (sum of months) = Sum(63)m =												-877.1154 (63)
Output from w/h	145.2477	110.4634	88.4545	43.5402	19.6240	0.0000	0.0000	19.1746	42.9573	87.8287	121.8383	144.8767 (64)
Total per year (kWh/year) = Sum(64)m =												824.0055 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (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	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(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)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(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	3.9300	11.9814	0.4400	0.0000	0.7700	15.9531 (74)
East	0.4800	22.3313	0.4400	0.0000	0.7700	3.6316 (76)
South	5.1600	50.9848	0.4400	0.0000	0.7700	89.1321 (78)
West	6.9700	22.3313	0.4400	0.0000	0.7700	52.7340 (80)

Solar gains	161.4508	257.8650	372.5663	511.7584	586.4964	635.1253	600.8511	542.3625	450.6128	311.6373	200.3604	135.3821 (83)
Total gains	760.9334	852.7097	944.2460	1047.4439	1085.2039	1100.7786	1047.2276	997.4400	926.4393	823.6794	752.6678	718.2734 (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	40.6219	40.7923	40.7923	41.0349	41.0349	41.3328	41.2611	41.4026	41.3328	41.1876	41.1876	40.9558
alpha	3.7081	3.7195	3.7195	3.7357	3.7357	3.7555	3.7507	3.7602	3.7555	3.7458	3.7458	3.7304
util living area												
	0.9798	0.9685	0.9397	0.8689	0.7336	0.5105	0.3452	0.3716	0.6573	0.8892	0.9637	0.9831 (86)
MIT	19.5887	19.7669	20.1032	20.5027	20.8123	20.9662	20.9943	20.9926	20.9085	20.5367	20.0088	19.5563 (87)
Th 2	19.8279	19.8322	19.8322	19.8383	19.8383	19.8456	19.8439	19.8473	19.8456	19.8420	19.8420	19.8363 (88)
util rest of house												
	0.9745	0.9602	0.9234	0.8332	0.6630	0.4032	0.2187	0.2408	0.5547	0.8503	0.9524	0.9786 (89)
MIT 2	18.0037	18.2621	18.7397	19.2894	19.6728	19.8283	19.8428	19.8458	19.7850	19.3511	18.6198	17.9629 (90)
Living area fraction									fLA = Living area / (4) =			0.1925 (91)
MIT	18.3087	18.5517	19.0021	19.5229	19.8921	20.0473	20.0644	20.0665	20.0012	19.5793	18.8871	18.2696 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1587	18.4017	18.8521	19.3729	19.7421	19.8973	19.9144	19.9165	19.8512	19.4293	18.7371	18.1196 (93)

Regs Region: England

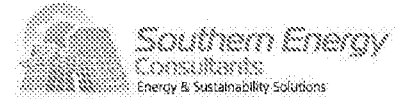
Elmhurst Energy Systems

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9635	0.9462	0.9056	0.8161	0.6565	0.4082	0.2266	0.2488	0.5553	0.8330	0.9375	0.9687	(94)
Useful gains	733.1285	806.8698	855.1413	854.8391	712.4320	449.3606	237.2512	248.1486	514.4304	686.1612	705.5935	695.7909	(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													
	1566.9156	1529.6489	1368.3914	1125.2121	800.8431	459.5926	237.9611	249.1652	548.4989	926.5287	1270.6463	1549.4746	(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													
	620.3376	485.7075	381.8580	194.6686	65.7779	0.0000	0.0000	0.0000	0.0000	178.8334	406.8380	635.1407	(98)
Space heating													
Space heating per m2												2969.1618	(98)
											(98) / (4) =	32.5780	(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													3280.8418 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	620.3376	485.7075	381.8580	194.6686	65.7779	0.0000	0.0000	0.0000	0.0000	178.8334	406.8380	635.1407	(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)	685.4560	536.6934	421.9426	215.1034	72.6827	0.0000	0.0000	0.0000	0.0000	197.6060	449.5448	701.8129	(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	145.2477	110.4634	88.4545	43.5402	19.6240	0.0000	0.0000	19.1746	42.9573	87.8287	121.8383	144.8767	(64)
Efficiency of water heater	89.8750	89.8895	89.8804	89.8977	89.7441	87.3000	87.3000	87.3000	87.3000	89.4204	89.7419	89.8880	(216)
(217)m	89.8750	89.8895	89.8804	89.8977	89.7441	87.3000	87.3000	87.3000	87.3000	89.4204	89.7419	89.8880	(217)
Fuel for water heating, kWh/month	161.6108	122.8881	98.4136	48.4331	21.8666	0.0000	0.0000	21.9640	49.2066	98.2200	135.7652	161.1746	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3280.8418 (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)													387.2964 (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													2888.5211 (238)

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

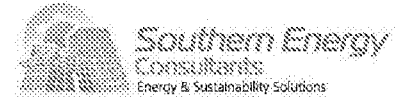
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3280.8418	3.8700	126.9686	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	919.5425	3.8700	35.5863	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	387.2964	18.9000	73.1990	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			7.6127	(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	3280.8418	0.2160	708.6618	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	919.5425	0.2160	198.6212	(264)
Space and water heating			907.2830	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	387.2964	0.5190	201.0068	(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 226.4260 (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	3280.8418	1.2200	4002.6270 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	919.5425	1.2200	1121.8419 (264)
Space and water heating			5124.4689 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	387.2964	3.0700	1189.0000 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1097.0487 (272)
Primary energy kWh/m2/year			12.0370 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	192.5 (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	291.14 (P1)
Transmission heat loss coefficient	78.20 (37)
Summer heat loss coefficient	369.34 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.9300	81.1852	0.4400	0.0000	0.9000	126.3469
East	0.4800	117.5071	0.4400	0.0000	0.9000	22.3357
South	5.1600	112.2060	0.4400	0.0000	0.9000	229.2772
West	6.9700	117.5071	0.4400	0.0000	0.9000	324.3336

total: 702.2935

	Jun	Jul	Aug	
Solar gains	742	702	634	(P4)
Internal gains	463	443	452	
Total summer gains	1205	1146	1086	(P5)
Summer gain/loss ratio	3.26	3.10	2.94	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 192.5)	0.65	0.65	0.65	
Threshold temperature	19.91	21.65	21.39	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			