

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG004a		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Lockwood, Plot 70				
SAP Rating	83 B	DER	18.29	TET	18.64
Environmental	85 B	% DER<TET	1.88		
CO ₂ Emissions (t/year)	1.37	DPEE	52.66	TPEE	56.63
General Requirements Compliance	Pass	% DPEE<TPEE	7.00		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey			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) 18.64 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.29 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)52.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.20 (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:

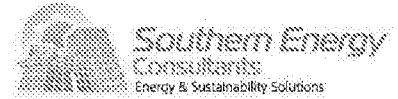
Overshading: Average
Windows facing North East: 8.18 m², No overhang
Windows facing South West: 6.97 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.039 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)
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)			15.1500	1.2357	18.7215		(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	19.4500	113.3100	0.2500	28.3275	60.0000	6798.6000 (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) =		67.6257		(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) = 17630.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.4447 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7343 (36)
Total fabric heat loss (33) + (36) = 76.3599 (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	120.7053	120.3965	120.0938	118.6719	118.4059	117.1675	117.1675	116.9382	117.6445	118.4059	118.9441	119.5067 (39)
Average = Sum(39)m / 12 =												118.6707 (39)
HLP	1.3244	1.3210	1.3177	1.3021	1.2992	1.2856	1.2856	1.2831	1.2908	1.2992	1.3051	1.3112 (40)
HLP (average)												1.3021 (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	22.2657	19.7762	16.0831	12.1759	9.1017	7.6840	8.3028	10.7923	14.4855	18.3926	21.4669	22.8846 (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	404.4505	402.2205	387.5621	363.8938	339.7584	316.6221	301.6814	307.9744	320.2168	344.1064	371.5292	392.1951 (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
Northeast				8.1800	11.2829	0.4400		0.0000		0.7700		31.2694 (75)
Southwest				6.9700	36.7938	0.4400		0.0000		0.7700		86.8863 (79)
Solar gains	118.1556	211.6492	317.1758	439.2383	534.1910	548.8937	521.4659	447.7886	358.9991	241.3559	143.4147	99.8927 (83)
Total gains	522.6061	613.8696	704.7380	803.1321	873.9494	865.5159	823.1473	755.7630	679.2158	585.4623	514.9439	492.0878 (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	40.5730	40.6771	40.7796	41.2682	41.3609	41.7981	41.7981	41.8800	41.6286	41.3609	41.1738	40.9799
alpha	3.7049	3.7118	3.7186	3.7512	3.7574	3.7865	3.7865	3.7920	3.7752	3.7574	3.7449	3.7320
util living area	0.9950	0.9904	0.9791	0.9468	0.8702	0.7310	0.5818	0.6415	0.8546	0.9669	0.9912	0.9960 (86)
MIT	19.1929	19.3915	19.7280	20.1800	20.5862	20.8572	20.9553	20.9352	20.7186	20.1918	19.6135	19.1614 (87)
Th 2	19.8218	19.8244	19.8270	19.8392	19.8415	19.8521	19.8521	19.8541	19.8480	19.8415	19.8369	19.8320 (88)
util rest of house	0.9936	0.9877	0.9729	0.9299	0.8267	0.6408	0.4491	0.5101	0.7888	0.9533	0.9883	0.9949 (89)
MIT 2	17.4254	17.7162	18.2059	18.6589	19.4118	19.7437	19.8319	19.8213	19.5977	18.8876	18.0493	17.3858 (90)
Living area fraction	17.7655	18.0387	18.4988	19.1131	19.6378	19.9580	20.0481	20.0357	19.8135	19.1386	18.3503	17.7275 (92)
Temperature adjustment	17.6155	17.8887	18.3488	18.9631	19.4878	19.8080	19.8981	19.8857	19.6635	18.9886	18.2003	-0.1500
adjusted MIT												17.5775 (93)

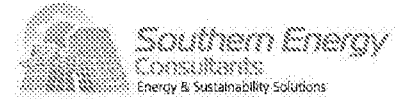
8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9894	0.9809	0.9616	0.9128	0.8104	0.6369	0.4548	0.5141	0.7757	0.9387	0.9818	0.9914 (94)
Ext temp.	517.0861	602.1329	677.6767	733.1188	708.2909	551.2244	374.4044	388.5550	526.8646	549.5748	505.5957	487.8789 (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	1607.2541	1563.7881	1422.9704	1194.2131	922.1215	610.2128	386.4287	407.6085	654.5098	993.2643	1320.3182	1598.7049 (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	811.0850	646.2323	554.4985	331.9879	159.0900	0.0000	0.0000	0.0000	0.0000	330.1050	586.6001	826.4545 (98)
Space heating per m2												4246.0533 (98)
(98) / (4) = 46.5883 (99)												

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													4691.7716 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	811.0850	646.2323	554.4985	331.9879	159.0900	0.0000	0.0000	0.0000	0.0000	330.1050	586.6001	826.4545	(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)	896.2265	714.0688	612.7055	366.8374	175.7901	0.0000	0.0000	0.0000	0.0000	364.7569	648.1770	913.2094	(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	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	89.9226	89.8759	89.7746	89.5363	89.0120	87.3000	87.3000	87.3000	87.3000	89.5072	89.8131	89.9451	(217)
Fuel for water heating, kWh/month	191.5478	168.0541	174.6493	154.1295	149.8536	133.4888	125.3239	141.4982	142.5034	160.0279	172.1953	185.9401	(219)
Water heating fuel used												1899.2121	(219)
Annual totals kWh/year													
Space heating fuel - main system												4691.7716	(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)												393.2195	(232)
Total delivered energy for all uses												7059.2033	(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	4691.7716	0.2160	1013.4227 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1899.2121	0.2160	410.2298 (264)
Space and water heating			1423.6525 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.2195	0.5190	204.0809 (268)
Total CO2, kg/year			1666.6584 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.2900 (273)

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

DER		18.2900	2C1
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	2C2
CO2 emissions from cooking, equation (L16)		2.0011	2C3
Total CO2 emissions		35.9710	2C4
Residual CO2 emissions offset from biofuel CHP		0.0000	2C5
Additional allowable electricity generation, kWh/m²/year		0.0000	2C6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	2C7
Net CO2 emissions		35.9710	2C8

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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	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1360 (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)				
Wind speed	Jan 5.1000	Feb 5.0000	Mar 4.9000	Apr 4.4000	May 4.3000	Jun 3.8000	Jul 3.8000	Aug 3.7000	Sep 4.0000	Oct 4.3000	Nov 4.5000	Dec 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)			15.1500	1.3258	20.0852		(27)					
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)					
Brick Cavity	132.7600	19.4500	113.3100	0.1800	20.3958		(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) =	57.0592		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7961 (36)					
Total fabric heat loss						(33) + (36) =	67.8553 (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	110.6167	110.3694	110.1269	108.9883	108.7752	107.7835	107.7835	107.5998	108.1655	108.7752	109.2062	109.6568 (39)
Average = Sum(39)m / 12 =												108.9873 (39)
HLP	Jan 1.2137	Feb 1.2110	Mar 1.2083	Apr 1.1958	May 1.1935	Jun 1.1826	Jul 1.1826	Aug 1.1806	Sep 1.1868	Oct 1.1935	Nov 1.1982	Dec 1.2032 (40)
HLP (average)												1.1958 (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	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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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.3792	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	22.2657	19.7762	16.0831	12.1759	9.1017	7.6840	8.3028	10.7923	14.4855	18.3926	21.4669	22.8846 (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	416.8237	414.5978	399.7543	375.4375	350.6489	326.8617	311.9286	318.8722	331.7711	356.3094	383.9125	404.5724 (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			
Northeast												8.1800	11.2829			0.6300			0.7000			0.7700		28.2064 (75)	
Southwest												6.9700	36.7938			0.6300			0.7000			0.7700		78.3754 (79)	
Solar gains	106.5818	190.9172	286.1070	396.2129	481.8646	495.1271	470.3860	403.9256	323.8335	217.7140	129.3666			90.1077	(83)										
Total gains	523.4055	605.5150	685.8614	771.6504	832.5135	821.9888	782.3146	722.7978	655.6046	574.0234	513.2790			494.6801	(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	57.2171	57.3453	57.4716	58.0720	58.1857	58.7211	58.7211	58.8213	58.5137	58.1857	57.9561	57.7180
alpha	4.8145	4.8230	4.8314	4.8715	4.8790	4.9147	4.9147	4.9214	4.9009	4.8790	4.8637	4.8479
util living area	0.9983	0.9963	0.9903	0.9681	0.8997	0.7509	0.5847	0.6473	0.8795	0.9817	0.9966	0.9988 (86)
MIT	19.6505	19.8039	20.0644	20.4158	20.7315	20.9256	20.9828	20.9723	20.8263	20.4195	19.9719	19.6241 (87)
Th 2	19.9091	19.9112	19.9133	19.9233	19.9252	19.9339	19.9339	19.9356	19.9306	19.9252	19.9214	19.9175 (88)
util rest of house	0.9978	0.9950	0.9867	0.9553	0.8583	0.6582	0.4539	0.5155	0.8140	0.9720	0.9952	0.9983 (89)
MIT 2	18.1122	18.3375	18.7180	19.2284	19.6555	19.8831	19.9275	19.9238	19.7852	19.2418	18.5908	18.0794 (90)
Living area fraction	18.4082	18.6197	18.9771	19.4569	19.8626	20.0837	20.1306	20.1256	19.9855	19.4685	18.8566	0.1925 (91)
MIT	18.4082	18.6197	18.9771	19.4569	19.8626	20.0837	20.1306	20.1256	19.9855	19.4685	18.8566	18.3766 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4082	18.6197	18.9771	19.4569	19.8626	20.0837	20.1306	20.1256	19.9855	19.4685	18.8566	18.3766 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	521.5945	601.1240	673.6833	731.5075	712.1917	552.7823	374.7986	390.7498	536.3488	554.6419	509.6976	493.3687 (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	1560.6068	1514.2391	1374.0641	1150.5830	887.8869	591.0523	380.5390	400.8714	636.6119	964.6702	1283.8952	1554.5658 (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	773.0251	613.6133	521.0833	301.7344	130.7172	0.0000	0.0000	0.0000	0.0000	305.0610	557.4223	789.5306 (98)
Space heating												3992.1872 (98)
Space heating per m2												(98) / (4) = 43.8028 (99)

8c. Space cooling requirement

Not applicable

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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													4274.2903 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	773.0251	613.6133	521.0833	301.7344	130.7172	0.0000	0.0000	0.0000	0.0000	305.0610	557.4223	789.5306	(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)	827.6500	656.9736	557.9050	323.0561	139.9542	0.0000	0.0000	0.0000	0.0000	326.6178	596.8119	845.3219	(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	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	88.0426	87.8477	87.4271	86.4626	84.4600	80.3000	80.3000	80.3000	80.3000	86.3748	87.5957	88.1234	(216)
Fuel for water heating, kWh/month	237.4620	209.8066	220.8410	198.0599	196.3036	181.8500	174.2262	194.2213	196.3663	207.8761	217.2684	231.5829	(219)
Water heating fuel used													2465.8644 (219)
Annual totals kWh/year													
Space heating fuel - main system													4274.2903 (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)													393.2195 (232)
Total delivered energy for all uses													7208.3742 (238)

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

	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year
Space heating - main system 1	4274.2903	0.2160	923.2467 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2465.8644	0.2160	532.6267 (264)
Space and water heating			1455.8734 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.2195	0.5190	204.0809 (268)
Total CO ₂ , kg/m ² /year			1698.8794 (272)
Emissions per m ² for space and water heating			15.9740 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m ² for lighting			2.2392 (272b)
Emissions per m ² for pumps and fans			0.4271 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.9740 * 1.00) + 2.2392 + 0.4271, rounded to 2 d.p.			18.6400 (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)			15.1500	1.2357	18.7215		(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	19.4500	113.3100	0.2500	28.3275	60.0000	6798.6000 (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) =		67.6257		(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) = 17220.4200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 188.9447 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7343 (36)
Total fabric heat loss (33) + (36) = 76.3599 (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	119.1213	118.8740	118.6315	117.4929	117.2798	116.2881	116.2881	116.1045	116.6701	117.2798	117.7108	118.1614 (39)
Average = Sum(39)m / 12 =												117.4919 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3070	1.3043	1.3016	1.2891	1.2868	1.2759	1.2759	1.2739	1.2801	1.2868	1.2915	1.2965 (40)
HLP (average)												1.2891 (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 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	22.2657	19.7762	16.9831	12.1759	9.1017	7.6840	8.3028	10.7923	14.4855	18.3926	21.4669	22.8846	(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	371.1990	369.7811	356.8104	335.4386	312.7949	291.7569	278.5963	282.6050	294.0332	315.5465	340.2887	359.7524	(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
Northeast				8.1800	11.2829		0.4400		0.0000		0.7700		31.2694 (75)
Southwest				6.9700	36.7938		0.4400		0.0000		0.7700		86.8863 (79)
Solar gains	118.1556	211.6492	317.1758	439.2383	534.1910	548.8937	521.4659	447.7886	358.9991	241.3559	143.4147	99.8927	(83)
Total gains	489.3547	581.4303	673.9863	774.6769	846.9860	840.6506	800.0623	730.3935	653.0323	556.9024	483.7034	459.6450	(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	40.1561	40.2397	40.3219	40.7127	40.7866	41.1345	41.1345	41.1995	40.9998	40.7866	40.6373	40.4823	
alpha	3.6771	3.6826	3.6881	3.7142	3.7191	3.7423	3.7423	3.7466	3.7333	3.7191	3.7092	3.6988	
util living area	0.9957	0.9913	0.9806	0.9494	0.8748	0.7386	0.5904	0.6526	0.8625	0.9698	0.9923	0.9966	(86)
MIT	19.1475	19.3495	19.6921	20.1504	20.5667	20.8469	20.9511	20.9287	20.7000	20.1581	19.5692	19.1124	(87)
Th 2	19.8353	19.8375	19.8395	19.8493	19.8512	19.8597	19.8597	19.8613	19.8564	19.8512	19.8475	19.8436	(88)
util rest of house	0.9945	0.9889	0.9749	0.9334	0.8330	0.6502	0.4581	0.5222	0.7996	0.9574	0.9898	0.9956	(89)
MIT 2	18.1532	18.3558	18.6969	19.1518	19.5409	19.7789	19.8442	19.8359	19.6711	19.1677	18.5831	18.1243	(90)
Living area fraction										fLA = Living area / (4) =		0.1925	(91)
MIT	18.3445	18.5470	18.8884	19.3440	19.7384	19.9845	20.0572	20.0462	19.8691	19.3583	18.7729	18.3145	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3445	18.5470	18.8884	19.3440	19.7384	19.9845	20.0572	20.0462	19.8691	19.3583	18.7729	18.3145	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	485.5734	572.8353	652.8572	716.2528	701.4016	555.6613	386.1983	398.4053	522.7460	529.1967	477.1338	456.8063	(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	1673.0042	1622.2764	1469.6559	1227.0975	942.7372	626.1475	402.0309	423.3396	673.0825	1027.1689	1374.0223	1667.7866	(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	883.4485	705.2244	607.6982	367.8082	179.5537	0.0000	0.0000	0.0000	0.0000	370.4914	645.7598	900.9694	(98)
Space heating												4660.9535	(98)
Space heating per m2										(98) / (4) =		51.1406	(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	1093.1082	860.5320	882.3938	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7853	0.8546	0.8188	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	858.4386	735.4081	722.4811	0.0000	0.0000	0.0000	0.0000	(102)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

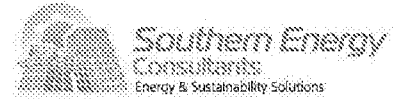


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1082.6414	1033.1098	953.5037	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	161.4261	221.4901	171.8809	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												554.7970 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	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	40.3565	55.3725	42.9702	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												138.6992 (107)
Space cooling per m2												1.5218 (108)
Energy for space heating												51.1406 (99)
Energy for space cooling												1.5218 (108)
Total												52.6624 (109)
Dwelling Fabric Energy Efficiency (DFEE)												52.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)
Air changes per hour					
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
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)			15.1500	1.3258	20.0852		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Brick Cavity	132.7600	19.4500	113.3100	0.1800	20.3958		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(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) =	57.0592		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.7961 (36)
Total fabric heat loss						(33) + (36) =	67.8553 (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	110.6167	110.3694	110.1269	108.9883	108.7752	107.7835	107.7835	107.5998	108.1655	108.7752	109.2062	109.6568 (39)
Average = Sum(39)m / 12 =												108.9873 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2137	1.2110	1.2083	1.1958	1.1935	1.1826	1.1826	1.1806	1.1868	1.1935	1.1982	1.2032 (40)
HLP (average)												1.1958 (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)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.5981	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	22.2657	19.7762	16.0831	12.1759	9.1017	7.6840	8.3028	10.7923	14.4855	18.3926	21.4669	22.8846	(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	371.1990	369.7811	356.8104	335.4386	312.7949	291.7569	278.5963	282.6050	294.0332	315.5465	340.2887	359.7524	(73)

6. Solar gains

[Jan]													
				Area	Solar flux			g	FF			Access	Gains
				m2	Table 6a			or Table 6b	Specific data	Specific data	factor		W
					W/m2				or Table 6c	or Table 6c	Table 6d		
Northeast				8.1800	11.2829			0.6300	0.7000		0.7700		28.2064 (75)
Southwest				6.9700	36.7938			0.6300	0.7000		0.7700		78.3754 (79)
Solar gains	106.5818	190.9172	286.1070	396.2129	481.8646	495.1271	470.3860	403.9256	323.8335	217.7140	129.3666	90.1077	(83)
Total gains	477.7808	560.6983	642.9175	731.6515	794.6595	786.8840	748.9823	686.5306	617.8667	533.2605	469.6553	449.8601	(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	57.2171	57.3453	57.4716	58.0720	58.1857	58.7211	58.7211	58.8213	58.5137	58.1857	57.9561	57.7180	
alpha	4.8145	4.8230	4.8314	4.8715	4.8790	4.9147	4.9147	4.9214	4.9009	4.8790	4.8637	4.8479	
util living area	0.9989	0.9974	0.9926	0.9739	0.9129	0.7720	0.6068	0.6740	0.8985	0.9864	0.9977	0.9992	(86)
MIT	19.6044	19.7590	20.0225	20.3805	20.7074	20.9156	20.9798	20.9670	20.8043	20.3812	19.9281	19.5786	(87)
Th 2	19.9091	19.9112	19.9133	19.9233	19.9252	19.9339	19.9339	19.9356	19.9306	19.9252	19.9214	19.9175	(88)
util rest of house	0.9985	0.9964	0.9898	0.9631	0.8751	0.6807	0.4729	0.5402	0.8389	0.9789	0.9967	0.9989	(89)
MIT 2	18.6362	18.7921	19.0560	19.4157	19.7215	19.8937	19.9287	19.9257	19.8156	19.4219	18.9693	18.6171	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.8225	18.9782	19.2420	19.6014	19.9112	20.0904	20.1310	20.1261	20.0059	19.6065	19.1538	18.8021	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8225	18.9782	19.2420	19.6014	19.9112	20.0904	20.1310	20.1261	20.0059	19.6065	19.1538	18.8021	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	476.8017	558.0651	634.8100	701.5799	694.9374	547.3788	373.7375	388.6015	521.5245	520.4033	467.6407	449.1729	(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	1606.4356	1553.8017	1403.2391	1166.3227	893.1759	591.7742	380.5802	400.9304	638.8125	979.6837	1316.3541	1601.2230	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	840.4476	669.1350	571.7112	334.6148	147.4895	0.0000	0.0000	0.0000	0.0000	341.7046	611.0737	857.1253	(98)
Space heating												4373.3017	(98)
Space heating per m2												47.9844	(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	1013.1649	797.5979	817.7588	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8336	0.9020	0.8692	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	844.6048	719.4092	710.8040	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1019.7973	973.4059	902.2354	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	126.1386	188.9736	142.4249	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												457.5371	(104)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

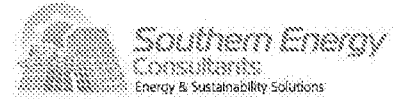


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	31.5346	47.2434	35.6062	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												114.3843 (107)
Space cooling per m2												1.2550 (108)
Energy for space heating												47.9844 (99)
Energy for space cooling												1.2550 (108)
Total												49.2395 (109)
Target Fabric Energy Efficiency (TFEE)												56.6 (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)			15.1500	1.2357	18.7215		(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	19.4500	113.3100	0.2500	28.3275	60.0000	6798.6000 (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) =		67.6257		(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) = 17630.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.4447 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7343 (36)
Total fabric heat loss (33) + (36) = 76.3599 (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	118.1460	117.6445	117.6445	116.9382	116.9382	116.0820	116.2869	115.8833	116.0820	116.4979	116.4979	117.1675 (39)
Average = Sum(39)m / 12 =												116.8174 (39)
HLP	1.2963	1.2908	1.2908	1.2831	1.2831	1.2737	1.2759	1.2715	1.2737	1.2782	1.2782	1.2856 (40)
HLP (average)												1.2817 (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

**Southern Energy
Consultants**
Energy & Sustainability Solutions

[illegible][illegible]

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)
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	0.5813	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)			15.1500	1.2357	18.7215		(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	19.4500	113.3100	0.2500	28.3275	60.0000	6798.6000 (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) =		67.6257		(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) = 17630.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.4447 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7343 (36)
Total fabric heat loss (33) + (36) = 76.3599 (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	120.7053	120.3965	120.0938	118.6719	118.4059	117.1675	117.1675	116.9382	117.6445	118.4059	118.9441	119.5067 (39)
Average = Sum(39)m / 12 =												118.6707 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3244	1.3210	1.3177	1.3021	1.2992	1.2856	1.2856	1.2831	1.2908	1.2992	1.3051	1.3112 (40)
HLP (average)												1.3021 (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 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	55.6643	49.4405	40.2077	30.4398	22.7541	19.2100	20.7571	26.9809	36.2136	45.9815	53.6672	57.2114	(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	600.3211	595.5894	572.2854	536.1440	499.0502	465.9426	446.6892	455.4839	476.3719	512.7347	553.1158	583.7531	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	PF Specific data or Table 6c	Access factor Table 6d	Gains W			
Northeast				8.1800	11.2829	0.4400	0.0000	0.7700	31.2694 (75)			
Southwest				6.9700	36.7938	0.4400	0.0000	0.7700	86.8863 (79)			
Solar gains	118.1556	211.6492	317.1758	439.2383	534.1910	548.8937	521.4659	447.7886	358.9991	241.3559	143.4147	99.8927 (83)
Total gains	718.4768	807.2386	889.4613	975.3823	1033.2412	1014.8363	968.1551	903.2725	835.3710	754.0906	696.5305	683.6458 (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	40.5730	40.6771	40.7796	41.2682	41.3609	41.7981	41.7981	41.8800	41.6286	41.3609	41.1738	40.9799	
alpha	3.7049	3.7118	3.7186	3.7512	3.7574	3.7865	3.7865	3.7920	3.7752	3.7574	3.7449	3.7320	
util living area	0.9858	0.9770	0.9580	0.9106	0.8142	0.6587	0.5084	0.5587	0.7791	0.9320	0.9769	0.9881	(86)
MIT	19.4204	19.6100	19.9241	20.3351	20.6843	20.9009	20.9716	20.9595	20.8042	20.3579	19.8197	19.3860	(87)
Th 2	19.8218	19.8244	19.8270	19.8392	19.8415	19.8521	19.8521	19.8541	19.8480	19.8415	19.8369	19.8320	(88)
util rest of house	0.9821	0.9711	0.9467	0.8855	0.7616	0.5669	0.3865	0.4352	0.7002	0.9075	0.9698	0.9850	(89)
MIT 2	17.7551	18.0307	18.4830	19.0667	19.5264	19.7806	19.8399	19.8349	19.6854	19.1123	18.3453	17.7120	(90)
Living area fraction	18.0756	18.3346	18.7603	19.3108	19.7492	19.9962	20.0577	20.0513	19.9007	19.3520	18.6290	18.0341	(91)
MIT	17.9256	18.1846	18.6103	19.1608	19.5992	19.8462	19.9077	19.9013	19.7507	19.2020	18.4790	17.8841	(92)
Temperature adjustment												-0.1500	
adjusted MIT												17.8841	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9733	0.9592	0.9308	0.8671	0.7488	0.5664	0.3927	0.4407	0.6925	0.8897	0.9579	0.9772	(94)
Useful gains	699.2712	774.3325	827.9104	845.7789	773.7036	574.7544	380.2100	398.0387	578.4667	670.9083	667.1839	668.0436	(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	1644.6807	1599.4235	1454.3749	1217.6653	935.3159	614.6838	387.5580	409.4361	664.7712	1018.5260	1353.4679	1635.3449	(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	703.3846	554.4612	466.0896	267.7583	120.2396	0.0000	0.0000	0.0000	0.0000	258.6276	494.1245	719.6721	(98)
Space heating												3584.3574	(98)
Space heating per m2												39.3280	(99)
(98) / (4) =													

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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													3960.6159 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	703.3846	554.4612	466.0896	267.7583	120.2396	0.0000	0.0000	0.0000	0.0000	258.6276	494.1245	719.6721	(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)	777.2206	612.6643	515.0161	295.8655	132.8614	0.0000	0.0000	0.0000	0.0000	285.7763	545.9939	795.2178	(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	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	89.8521	89.7953	89.6726	89.3857	88.7884	87.3000	87.3000	87.3000	87.3000	89.3329	89.7161	89.8788	(216)
Fuel for water heating, kWh/month	191.6981	168.2049	174.8480	154.3893	150.2310	133.4888	125.3239	141.4982	142.5034	160.3401	172.3816	186.0773	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3960.6159 (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)													393.2195 (232)
Total delivered energy for all uses													6329.8204 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3960.6159	3.4800	137.8294 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1900.9849	3.4800	66.1543 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	393.2195	13.1900	51.8657 (250)
Additional standing charges			120.0000 (251)
Total energy cost			385.7419 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1900 (257)
SAP value		83.3990
SAP rating (Section 12)		83 (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	3960.6159	0.2160	855.4930 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1900.9849	0.2160	410.6127 (264)
Space and water heating			1266.1058 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.2195	0.5190	204.0809 (268)
Total kg/year			1509.1117 (272)
CO2 emissions per m2			16.5600 (273)
EI value			85.1461
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	$3.48 / 0.8880 = 3.919$, stars = 4
Water heating environmental impact	$0.216 / 0.8880 = 0.2432$, stars = 4

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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)
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	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												
Effective ac	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)
	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)			15.1500	1.2357	18.7215		(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	19.4500	113.3100	0.2500	28.3275	60.0000	6798.6000 (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) =		67.6257		(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) = 17630.5500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.4447 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7343 (36)
Total fabric heat loss (33) + (36) = 76.3599 (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												
	118.1460	117.6445	117.6445	116.9382	116.9382	116.0820	116.2869	115.8833	116.0820	116.4979	116.4979	117.1675 (39)
Average = Sum(39)m / 12 =												116.8174 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2963	1.2908	1.2908	1.2831	1.2831	1.2737	1.2759	1.2715	1.2737	1.2782	1.2782	1.2856 (40)
HLP (average)												1.2817 (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	55.6643	49.4405	40.2077	30.4398	22.7541	19.2100	20.7571	26.9809	36.2136	45.9815	53.6672	57.2114	(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	600.3211	595.5894	572.2854	536.1440	499.0502	465.9426	446.6892	455.4839	476.3719	512.7347	553.1158	583.7531	(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	
Northeast				8.1800	12.9236	0.4400		0.0000	0.7700		35.8161 (75)	
Southwest				6.9700	40.4699	0.4400		0.0000	0.7700		95.5671 (79)	
Solar gains	131.3833	212.3898	316.0425	453.4918	538.8731	593.0099	557.1271	488.2948	388.6457	259.0712	163.4967	109.9292 (83)
Total gains	731.7044	807.9792	888.3279	989.6358	1037.9233	1058.9525	1003.8163	943.7787	865.0176	771.8059	716.6125	693.6824 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.4519	41.6286	41.6286	41.8800	41.8800	42.1889	42.1146	42.2613	42.1889	42.0383	42.0383	41.7981	
alpha	3.7635	3.7752	3.7752	3.7920	3.7920	3.8126	3.8076	3.8174	3.8126	3.8026	3.8026	3.7865	
util living area	0.9822	0.9732	0.9487	0.8832	0.7484	0.5216	0.3544	0.3861	0.6836	0.9041	0.9685	0.9850	(86)
MIT	19.5903	19.7522	20.0785	20.4833	20.8065	20.9657	20.9942	20.9921	20.8999	20.5152	19.9989	19.5628	(87)
Th 2	19.8437	19.8480	19.8480	19.8541	19.8541	19.8615	19.8597	19.8632	19.8615	19.8579	19.8579	19.8521	(88)
util rest of house	0.9775	0.9660	0.9344	0.8502	0.6793	0.4139	0.2264	0.2523	0.5818	0.8690	0.9586	0.9809	(89)
MIT 2	18.0160	18.2517	18.7173	19.2782	19.6819	19.8438	19.8586	19.8615	19.7938	19.3372	18.6168	17.9821	(90)
Living area fraction	18.3190	18.5404	18.9793	19.5101	19.8983	20.0597	20.0772	20.0791	20.0067	19.5639	18.8828	18.2863	(92)
Temperature adjustment	18.1690	18.3904	18.8293	19.3601	19.7483	19.9097	19.9272	19.9291	19.8567	19.4139	18.7328	-0.1500	
adjusted MIT												18.1363	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9674	0.9533	0.9177	0.8330	0.6721	0.4187	0.2341	0.2603	0.5813	0.8516	0.9448	0.9719	(94)
Useful gains	707.8596	770.2763	815.1868	824.3196	697.6059	443.4152	235.0093	245.6411	502.8677	657.2715	677.0402	674.1728	(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													
	1544.0503	1504.7255	1344.5939	1106.2488	789.1396	453.8475	235.7349	246.7302	540.5594	910.3058	1250.3434	1527.4345	(97)
Month fracti	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													
	622.1259	493.5498	393.8789	202.9890	68.1011	0.0000	0.0000	0.0000	0.0000	188.2576	412.7783	634.8267	(98)
Space heating													
Space heating per m2												3016.5072	(98)
										(98) / (4) =		33.0975	(99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

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													3333.1572 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	622.1259	493.5498	393.8789	202.9890	68.1011	0.0000	0.0000	0.0000	0.0000	188.2576	412.7783	634.8267	(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)	687.4319	545.3589	435.2253	224.2972	75.2498	0.0000	0.0000	0.0000	0.0000	208.0194	456.1086	701.4660	(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	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	89.7864	89.7293	89.5652	89.1771	88.3559	87.3000	87.3000	87.3000	87.3000	89.0890	89.6048	89.8135	(216)
Fuel for water heating, kWh/month	191.8385	168.3287	175.0577	154.7504	150.9662	133.4888	125.3239	141.4982	142.5034	160.7791	172.5957	186.2125	(219)
Water heating fuel used												1903.3431	(219)
Annual totals kWh/year													
Space heating fuel - main system												3333.1572	(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)													393.2195 (232)
Total delivered energy for all uses													5704.7198 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3333.1572	3.8700	128.9932 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1903.3431	3.8700	73.6594 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	393.2195	18.9000	74.3185 (250)
Additional standing charges			93.0000 (251)
Total energy cost			384.1461 (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	3333.1572	0.2160	719.9619 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.3431	0.2160	411.1221 (264)
Space and water heating			1131.0841 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	393.2195	0.5190	204.0809 (268)
Total kg/year			1374.0900 (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	3333.1572	1.2200	4066.4517 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.3431	1.2200	2322.0786 (264)
Space and water heating			6388.5304 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	393.2195	3.0700	1207.1840 (268)
Primary energy kWh/year			7825.9643 (272)
Primary energy kWh/m2/year			85.8675 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
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 (13.6%)
U Solar photovoltaic panels	+ 9.8	-£ 345	-947 kg (79.7%)

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	12.43 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	£88	£98	-£9
Mains gas	£296	£258	£38
Space heating	£236	£236	£0
Water heating	£74	£45	£29
Lighting	£74	£74	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£384	£11	£374
Total cost of uses	£384	£10	£374
Delivered energy	63 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	3 kg/m²	12 kg/m²
Primary energy	86 kWh/m²	13 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	0.5813	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)			15.1500	1.2357	18.7215		(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	19.4500	113.3100	0.2500	28.3275	60.0000	6798.6000 (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) =		67.6257		(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) = 17630.5500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.4447 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7343 (36)
 Total fabric heat loss (33) + (36) = 76.3599 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	120.7053	120.3965	120.0938	118.6719	118.4059	117.1675	117.1675	116.9382	117.6445	118.4059	118.9441	119.5067 (39)
Average = Sum(39)m / 12 =												118.6707 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.3244	1.3210	1.3177	1.3021	1.2992	1.2856	1.2856	1.2831	1.2908	1.2992	1.3051	1.3112 (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	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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

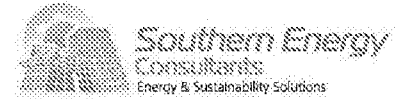
Elmhurst Energy Systems

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	-24.9478	-41.6307	-70.9019	-95.0225	-117.3923	-115.4153	-113.8901	-99.5063	-77.9334	-53.2193	-29.5917	-860.3285 (H17)
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)
(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	55.6643	49.4405	40.2077	30.4398	22.7541	19.2100	20.7571	26.9809	36.2136	45.9815	53.6672	57.2114	(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	600.3211	595.5894	572.2854	536.1440	499.0502	465.9426	446.6892	455.4839	476.3719	512.7347	553.1158	583.7531	(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		
Northeast				8.1800	11.2829		0.4400	0.0000	0.7700	31.2694 (75)		
Southwest				6.9700	36.7938		0.4400	0.0000	0.7700	86.8863 (79)		
Solar gains	118.1556	211.6492	317.1758	439.2383	534.1910	548.8937	521.4659	447.7886	358.9991	241.3559	143.4147	99.8927 (83)
Total gains	718.4768	807.2386	889.4613	975.3823	1033.2412	1014.8363	968.1551	903.2725	835.3710	754.0906	696.5305	683.6458 (84)

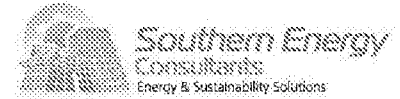
7. Mean internal temperature (heating season)

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	40.5730	40.6771	40.7796	41.2682	41.3609	41.7981	41.7981	41.8800	41.6286	41.3609	41.1738	40.9799	
alpha	3.7049	3.7118	3.7186	3.7512	3.7574	3.7865	3.7865	3.7920	3.7752	3.7574	3.7449	3.7320	
util living area	0.9858	0.9770	0.9580	0.9106	0.8142	0.6587	0.5084	0.5587	0.7791	0.9320	0.9769	0.9881	(86)
MIT	19.4204	19.6100	19.9241	20.3351	20.6843	20.9009	20.9716	20.9595	20.8042	20.3579	19.8197	19.3860	(87)
Th 2	19.8218	19.8244	19.8270	19.8392	19.8415	19.8521	19.8521	19.8541	19.8480	19.8415	19.8369	19.8320	(88)
util rest of house	0.9821	0.9711	0.9467	0.8855	0.7616	0.5669	0.3865	0.4352	0.7002	0.9075	0.9698	0.9850	(89)
MIT 2	17.7551	18.0307	18.4830	19.0667	19.5264	19.7806	19.8399	19.8349	19.6854	19.1123	18.3453	17.7120	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.0756	18.3346	18.7603	19.3108	19.7492	19.9962	20.0577	20.0513	19.9007	19.3520	18.6290	18.0341	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9256	18.1846	18.6103	19.1608	19.5992	19.8462	19.9077	19.9013	19.7507	19.2020	18.4790	17.8841	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9733	0.9592	0.9308	0.8671	0.7488	0.5664	0.3927	0.4407	0.6925	0.8897	0.9579	0.9772	(94)
Useful gains	699.2712	774.3325	827.9104	845.7789	773.7036	574.7544	380.2100	398.0387	578.4667	670.9083	667.1839	668.0436	(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	1644.6807	1599.4235	1454.3749	1217.6653	935.3159	614.6838	387.5580	409.4361	664.7712	1018.5260	1353.4679	1635.3449	(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	703.3846	554.4612	466.0896	267.7583	120.2396	0.0000	0.0000	0.0000	0.0000	258.6276	494.1245	719.6721	(98)
Space heating												3584.3574	(98)
Space heating per m2											(98) / (4) =	39.3280	(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													3960.6159	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	703.3846	554.4612	466.0896	267.7583	120.2396	0.0000	0.0000	0.0000	0.0000	258.6276	494.1245	719.6721	(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)	777.2206	612.6643	515.0161	295.8655	132.8614	0.0000	0.0000	0.0000	0.0000	285.7763	545.9939	795.2178	(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	89.9292	89.9566	89.9867	90.0435	90.1122	87.3000	87.3000	87.3000	87.3000	89.6515	89.8349	89.9428	(216)	
Fuel for water heating, kWh/month	163.7922	121.6247	95.4462	47.7319	17.7505	1.2834	0.0000	27.5162	53.2326	100.4077	139.2135	162.7334	(219)	
Water heating fuel used												930.7322	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3960.6159	(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)													393.2195	(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													3682.3283	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3960.6159	3.4800	137.8294	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	930.7322	3.4800	32.3895	(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	393.2195	13.1900	51.8657	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			130.7492	(255)

11a. SAP rating - Individual heating systems

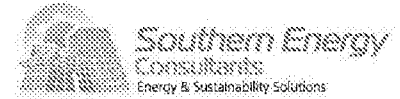
Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4034	(257)
SAP value		94.3730	
SAP rating (Section 12)		94	(258)
SAP band		A	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - main system 1	3960.6159	0.2160	855.4930 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	930.7322	0.2160	201.0382 (264)
Space and water heating			1056.5312 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	393.2195	0.5190	204.0809 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			429.0499 (272)
CO2 emissions per m2			4.7100 (273)
EI value			95.7769
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)			15.1500	1.2357	18.7215		(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	19.4500	113.3100	0.2500	28.3275	60.0000	6798.6000 (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) =		67.6257		(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) = 17630.5500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 193.4447 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 8.7343 (36)
 Total fabric heat loss (33) + (36) = 76.3599 (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	118.1460	117.6445	117.6445	116.9382	116.9382	116.0820	116.2869	115.8833	116.0820	116.4979	116.4979	117.1675 (39)
Average = Sum(39)m / 12 =												116.8174 (39)
HLP	1.2963	1.2908	1.2908	1.2831	1.2831	1.2737	1.2759	1.2715	1.2737	1.2782	1.2782	1.2856 (40)
HLP (average)												1.2817 (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)
(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	55.6643	49.4405	40.2077	30.4398	22.7541	19.2100	20.7571	26.9809	36.2136	45.9815	53.6672	57.2114	(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	600.3211	595.5894	572.2854	536.1440	499.0502	465.9426	446.6892	455.4839	476.3719	512.7347	553.1158	583.7531	(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	
Northeast	8.1800	12.9236	0.4400	0.0000	0.7700	35.8161	(75)
Southwest	6.9700	40.4699	0.4400	0.0000	0.7700	95.5671	(79)

Solar gains	131.3833	212.3898	316.0425	453.4918	538.8731	593.0099	557.1271	488.2948	388.6457	259.0712	163.4967	109.9292	(83)
Total gains	731.7044	807.9792	888.3279	989.6358	1037.9233	1058.9525	1003.8163	943.7787	865.0176	771.8059	716.6125	693.6824	(84)

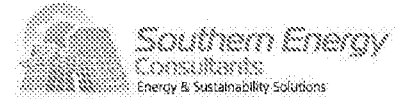
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
alpha	41.4519	41.6286	41.6286	41.8800	41.8800	42.1889	42.1146	42.2613	42.1889	42.0383	42.0383	41.7981	
util living area	3.7635	3.7752	3.7752	3.7920	3.7920	3.8126	3.8076	3.8174	3.8126	3.8026	3.8026	3.7865	
	0.9822	0.9732	0.9487	0.8832	0.7484	0.5216	0.3544	0.3861	0.6836	0.9041	0.9685	0.9850	(86)
MIT	19.5903	19.7522	20.0785	20.4833	20.8065	20.9657	20.9942	20.9921	20.8999	20.5152	19.9989	19.5628	(87)
Th 2	19.8437	19.8480	19.8480	19.8541	19.8541	19.8615	19.8597	19.8632	19.8615	19.8579	19.8579	19.8521	(88)
util rest of house	0.9775	0.9660	0.9344	0.8502	0.6793	0.4139	0.2264	0.2523	0.5818	0.8690	0.9586	0.9809	(89)
MIT 2	18.0160	18.2517	18.7173	19.2782	19.6819	19.8438	19.8586	19.8615	19.7938	19.3372	18.6168	17.9821	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.3190	18.5404	18.9793	19.5101	19.8983	20.0597	20.0772	20.0791	20.0067	19.5639	18.8828	18.2863	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.1690	18.3904	18.8293	19.3601	19.7483	19.9097	19.9272	19.9291	19.8567	19.4139	18.7328	18.1363	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9674	0.9533	0.9177	0.8330	0.6721	0.4187	0.2341	0.2603	0.5813	0.8516	0.9448	0.9719	(94)
Useful gains	707.8596	770.2763	815.1868	824.3196	697.6059	443.4152	235.0093	245.6411	502.8677	657.2715	677.0402	674.1728	(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	1544.0503	1504.7255	1344.5939	1106.2488	789.1396	453.8475	235.7349	246.7302	540.5594	910.3058	1250.3434	1527.4345	(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	622.1259	493.5498	393.8789	202.9890	68.1011	0.0000	0.0000	0.0000	0.0000	188.2576	412.7783	634.8267	(98)
Space heating												3016.5072	(98)
Space heating per m2										(98) / (4) =		33.0975	(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													3333.1572	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	622.1259	493.5498	393.8789	202.9890	68.1011	0.0000	0.0000	0.0000	0.0000	188.2576	412.7783	634.8267	(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)	687.4319	545.3589	435.2253	224.2972	75.2498	0.0000	0.0000	0.0000	0.0000	208.0194	456.1086	701.4660	(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	89.8764	89.8974	89.8957	89.9179	89.7640	87.3000	87.3000	87.3000	87.3000	89.4569	89.7503	89.8878	(217)	
Fuel for water heating, kWh/month	161.6082	122.8773	98.3968	48.4222	21.8618	0.0000	0.0000	21.9640	49.2066	98.1800	135.7526	161.1750	(219)	
Water heating fuel used												919.4444	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3333.1572	(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)													393.2195	(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													2946.6615	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3333.1572	3.8700	128.9932	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	919.4444	3.8700	35.5825	(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	393.2195	18.9000	74.3185	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			10.7530	(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	3333.1572	0.2160	719.9619	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	919.4444	0.2160	198.6000	(264)
Space and water heating			918.5619	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	393.2195	0.5190	204.0809	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			240.7790	(272)

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

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	3333.1572	1.2200	4066.4517 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	919.4444	1.2200	1121.7222 (264)
Space and water heating			5188.1740 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	393.2195	3.0700	1207.1840 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1178.9379 (272)
Primary energy kWh/m2/year			12.9355 (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	South West
Overshading	Average or unknown
Thermal mass parameter	193.4 (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	76.36 (37)
Summer heat loss coefficient	367.50 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	8.1800	98.8453	0.4400	0.0000	0.9000	320.1875
South West	6.9700	119.9223	0.4400	0.0000	0.9000	331.0001
total:						651.1876

	Jun	Jul	Aug	
Solar gains	693	651	571	(P4)
Internal gains	463	444	452	
Total summer gains	1156	1095	1023	(P5)
Summer gain/loss ratio	3.15	2.98	2.78	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 193.4)	0.65	0.65	0.65	
Threshold temperature	19.79	21.53	21.23	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			