

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG003g		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Re Ea Ga		
Property	Coniston+, Plot 7				
SAP Rating	84 B	DER	16.79	TER	17.29
Environmental	85 B	% DER<TER	2.88		
CO ₂ Emissions (t/year)	1.55	DPEE	50.72	TPEE	55.27
General Requirements Compliance	Pass	% DPEE<TPEE	8.25		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 113 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.29 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.79 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)55.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.7 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (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:

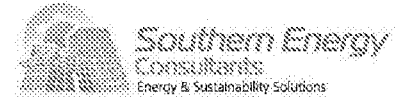
Overshading:
Average
Windows facing North East: 7.24 m², No overhang
Windows facing South East: 1.44 m², No overhang
Windows facing South West: 8.32 m², No overhang
Windows facing North West: 0.84 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =	0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	141.4171	141.0937	140.7767	139.2878	139.0092	137.7124	137.7124	137.4723	138.2119	139.0092	139.5728	140.1619 (39)
Average = Sum(39)m / 12 =												139.2865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2551	1.2523	1.2495	1.2362	1.2338	1.2223	1.2223	1.2201	1.2267	1.2338	1.2388	1.2440 (40)
HLP (average)												1.2362 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313	(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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411	(61)
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
												Total per year (kWh/year) = Sum(64)m =	1761.3181 (64)
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047	(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	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6620	22.7928	18.5363	14.0332	10.4900	8.8561	9.5693	12.4386	16.6950	21.1981	24.7414	26.3753	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3376	278.1948	270.9948	255.6671	236.3186	218.1337	205.9850	203.1279	210.3278	225.6556	245.0041	263.1890	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	448.1361	445.7772	429.4474	402.9906	375.7934	349.9149	333.3324	339.9431	353.7467	380.4355	411.0704	434.3637	(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			7.2400		11.2829		0.4400		0.0000		0.7700		27.6761 (75)
Southeast			1.4400		36.7938		0.4400		0.0000		0.7700		17.9507 (77)
Southwest			8.3200		36.7938		0.4400		0.0000		0.7700		103.7150 (79)
Northwest			0.8400		11.2829		0.4400		0.0000		0.7700		3.2110 (81)
Solar gains	152.5528	270.1133	396.8318	537.3705	643.5914	657.2760	626.0524	544.0033	445.0593	305.8803	184.5915	129.3445	(83)
Total gains	600.6889	715.8905	826.2792	940.3611	1019.3848	1007.1909	959.3848	883.9463	798.8060	686.3159	595.6619	563.7081	(84)

7. Mean internal temperature (heating season)

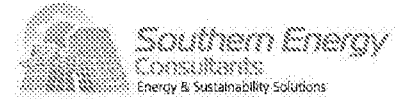
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.7534	42.8514	42.9479	43.4069	43.4939	43.9035	43.9035	43.9802	43.7448	43.4939	43.3183	43.1362	
alpha	3.8502	3.8568	3.8632	3.8938	3.8996	3.9269	3.9269	3.9320	3.9163	3.8996	3.8879	3.8757	
util living area	0.9962	0.9920	0.9817	0.9516	0.8783	0.7407	0.5889	0.6479	0.8605	0.9705	0.9929	0.9970	(86)
MIT	19.2492	19.4486	19.7771	20.2119	20.6035	20.8647	20.9590	20.9403	20.7339	20.2223	19.6562	19.2157	(87)
Th 2	19.8761	19.8784	19.8806	19.8911	19.8931	19.9022	19.9022	19.9039	19.8987	19.8931	19.8891	19.8850	(88)
util rest of house	0.9951	0.9898	0.9763	0.9363	0.8375	0.6540	0.4604	0.5209	0.7979	0.9583	0.9906	0.9962	(89)
MIT 2	17.5420	17.8342	18.3125	18.9413	19.4764	19.7976	19.8831	19.8729	19.6586	18.9666	18.1451	17.4987	(90)
Living area fraction	17.7602	18.0405	18.4996	19.1036	19.6205	19.9340	20.0206	20.0093	19.7960	19.1271	18.3382	17.7181	(91)
MIT	17.7602	18.0405	18.4996	19.1036	19.6205	19.9340	20.0206	20.0093	19.7960	19.1271	18.3382	17.7181	(92)
Temperature adjustment	17.6102	17.8905	18.3496	18.9536	19.4705	19.7840	19.8706	19.8593	19.6460	18.9771	18.1882	17.5681	(93)
adjusted MIT	17.6102	17.8905	18.3496	18.9536	19.4705	19.7840	19.8706	19.8593	19.6460	18.9771	18.1882	17.5681	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9916	0.9836	0.9654	0.9187	0.8183	0.6434	0.4564	0.5152	0.7798	0.9435	0.9848	0.9933	(94)
Useful gains	595.6357	704.1513	797.7074	863.9521	834.1423	647.9991	437.8294	455.4101	622.9474	647.5516	586.6277	559.9489	(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	1882.2912	1832.8786	1668.1541	1400.3502	1080.1658	713.8971	450.3993	475.5551	766.5293	1164.4923	1547.6162	1873.7038	(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	957.2718	758.5047	647.6123	386.2066	183.0415	0.0000	0.0000	0.0000	0.0000	384.6039	691.9117	977.4336	(98)
Space heating												4986.5862	(98)
Space heating per m2												(98) / (4) =	44.2583 (99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5510.0400 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	957.2718	758.5047	647.6123	386.2066	183.0415	0.0000	0.0000	0.0000	0.0000	384.6039	691.9117	977.4336	(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)	1057.7588	838.1268	715.5937	426.7476	202.2558	0.0000	0.0000	0.0000	0.0000	424.9767	764.5433	1080.0371	(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	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
Efficiency of water heater (217)m	89.9790	89.9333	89.8365	89.6089	89.0908	87.3000	87.3000	87.3000	87.3000	89.5821	89.8775	87.3000	(216)
Fuel for water heating, kWh/month	199.5823	175.0824	181.9046	160.4621	155.9517	138.9748	130.4075	147.3327	148.4088	166.5897	179.3525	193.7207	(219)
Water heating fuel used													1977.7698 (219)
Annual totals kWh/year													
Space heating fuel - main system													5510.0400 (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)													453.1995 (232)
Total delivered energy for all uses													8016.0093 (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	5510.0400	0.2160	1190.1686	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1977.7698	0.2160	427.1983	(264)
Space and water heating			1617.3669	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	453.1995	0.5190	235.2106	(268)
Total CO2, kg/year			1891.5025	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.7900	(273)

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

DER		16.7900	ZC1
Total Floor Area	TFA	112.6700	
Assumed number of occupants	N	2.8299	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		14.4812	ZC2
CO2 emissions from cooking, equation (L16)		1.6590	ZC3
Total CO2 emissions		32.9302	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		32.9302	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =	0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.3258	23.6515		(27)
Heat Loss Floor 1			56.8600	0.1300	7.3918		(28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.1800	22.9266		(29a)
Main Plane	55.8100		55.8100	0.1300	7.2553		(30)
Bay Roof	1.5000		1.5000	0.1300	0.1950		(30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.1502		(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)							12.6831 (36)
Total fabric heat loss						(33) + (36) =	78.8333 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	132.4150	132.0916	131.7746	130.2856	130.0071	128.7103	128.7103	128.4701	129.2098	130.0071	130.5706	131.1598 (39)
Average = Sum(39)m / 12 =												130.2843 (39)
HLP	1.1752	1.1724	1.1696	1.1563	1.1539	1.1424	1.1424	1.1402	1.1468	1.1539	1.1589	1.1641 (40)
HLP (average)												1.1563 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)
Energy content (annual)										Total = Sum(45)m =		1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m												
24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
Combi 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 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	49.0107	48.5773	45.0098	46.5102	48.5773	49.0107	50.9589	49.3151	50.9589 (61)
Solar input	216.3875	190.7123	200.2608	179.1757	173.4737	152.7859	146.3805	163.1800	164.9822	186.1125	196.8457	211.1677 (62)
Output from w/h	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)
Heat gains from water heating, kWh/month	216.3875	190.7123	200.2608	179.1757	173.4737	152.7859	146.3805	163.1800	164.9822	186.1125	196.8457	211.1677 (64)
	67.7447	59.6146	62.3826	55.5325	53.6724	47.0880	44.8344	50.2497	50.8132	57.6783	61.3827	66.0091 (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	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6620	22.7928	18.5363	14.0332	10.4900	8.8561	9.5693	12.4386	16.6950	21.1981	24.7414	26.3753	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3376	278.1948	270.9948	255.6671	236.3186	218.1337	205.9850	203.1279	210.3278	225.6556	245.0041	263.1890	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	91.0547	88.7122	83.8476	77.1285	72.1403	65.4000	60.2613	67.5400	70.5739	77.5246	85.2538	88.7220	(72)
Total internal gains	460.5035	458.1488	441.8278	415.2779	387.3979	360.8388	344.2648	351.5555	366.0457	392.8273	423.4483	446.7353	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	7.2400	11.2829	0.6300	0.7000	0.7700	24.9651 (75)
Southeast	1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)
Southwest	8.3200	36.7938	0.6300	0.7000	0.7700	93.5557 (79)
Northwest	0.8400	11.2829	0.6300	0.7000	0.7700	2.8965 (81)

Solar gains	137.6096	243.6545	357.9603	484.7326	580.5487	592.8928	564.7277	490.7157	401.4637	275.9180	166.5099	116.6746	(83)
Total gains	598.1130	701.8033	799.7881	900.0105	967.9465	953.7316	908.9925	842.2711	767.5095	668.7453	589.9582	563.4099	(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	59.0893	59.2340	59.3765	60.0550	60.1837	60.7901	60.7901	60.9037	60.5551	60.1837	59.9239	59.6548	
util living area	4.9393	4.9489	4.9584	5.0037	5.0122	5.0527	5.0527	5.0602	5.0370	5.0122	4.9949	4.9770	
	0.9989	0.9972	0.9922	0.9731	0.9113	0.7682	0.6002	0.6622	0.8901	0.9849	0.9975	0.9992	(86)
MIT	19.6609	19.8155	20.0721	20.4166	20.7276	20.9240	20.9827	20.9723	20.8262	20.4224	19.9794	19.6360	(87)
Th 2	19.9399	19.9422	19.9444	19.9551	19.9571	19.9664	19.9664	19.9681	19.9628	19.9571	19.9530	19.9488	(88)
util rest of house	0.9985	0.9962	0.9893	0.9621	0.8737	0.6786	0.4707	0.5325	0.8288	0.9769	0.9965	0.9989	(89)
MIT 2	18.1488	18.3764	18.7517	19.2546	19.6791	19.9132	19.9597	19.9560	19.8145	19.2700	18.6240	18.1188	(90)
Living area fraction	18.3421	18.5603	18.9205	19.4031	19.8131	20.0424	20.0905	20.0859	19.9438	19.4173	18.7973	18.3127	(91)
MIT	18.3421	18.5603	18.9205	19.4031	19.8131	20.0424	20.0905	20.0859	19.9438	19.4173	18.7973	18.3127	(92)
Temperature adjustment	18.3421	18.5603	18.9205	19.4031	19.8131	20.0424	20.0905	20.0859	19.9438	19.4173	18.7973	18.3127	(93)
adjusted MIT	18.3421	18.5603	18.9205	19.4031	19.8131	20.0424	20.0905	20.0859	19.9438	19.4173	18.7973	18.3127	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9975	0.9943	0.9851	0.9542	0.8673	0.6860	0.4870	0.5484	0.8275	0.9709	0.9947	0.9981	(94)
Useful gains	596.6143	697.7833	787.8819	858.8249	839.5236	654.2345	442.7129	461.9305	635.0901	649.2797	586.8191	562.3567	(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	1859.3831	1804.4088	1636.7025	1368.4025	1054.7657	700.4944	449.2617	473.5313	755.0785	1146.3111	1527.3184	1851.0172	(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	939.4999	743.6523	631.5225	366.8959	160.1401	0.0000	0.0000	0.0000	0.0000	369.7913	677.1595	958.7635	(98)
Space heating												4847.4251	(98)
Space heating per m2													(98) / (4) = 43.0232 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													5189.9626 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	939.4999	743.6523	631.5225	366.8959	160.1401	0.0000	0.0000	0.0000	0.0000	369.7913	677.1595	958.7635	(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)	1005.8886	796.2016	676.1483	392.8221	171.4562	0.0000	0.0000	0.0000	0.0000	395.9222	725.0102	1026.5134	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	216.3875	190.7123	200.2608	179.1757	173.4737	152.7859	146.3805	163.1800	164.9822	186.1125	196.8457	211.1677	(64)
Efficiency of water heater (217)m	88.3204	88.1373	87.7429	86.8171	84.8505	80.3000	80.3000	80.3000	80.3000	86.7471	87.9097	88.3933	(217)
Fuel for water heating, kWh/month	245.0029	216.3809	228.2358	206.3830	204.4461	190.2689	182.2921	203.2130	205.4572	214.5460	223.9181	238.8957	(219)
Water heating fuel used												2559.0397	(219)
Annual totals kWh/year													
Space heating fuel - main system												5189.9626	(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)												453.1995	(232)
Total delivered energy for all uses												8277.2019	(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	5189.9626	0.2160	1121.0319 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2559.0397	0.2160	552.7526 (264)
Space and water heating			1673.7845 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total CO ₂ , kg/m ² /year			1947.9201 (272)
Emissions per m ² for space and water heating			14.8556 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m ² for lighting			2.0876 (272b)
Emissions per m ² for pumps and fans			0.3455 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.8556 * 1.00) + 2.0876 + 0.3455, rounded to 2 d.p.			17.2900 (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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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)	=	0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			9.0000	502.2900 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21263.5200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.7239 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	141.4171	141.0937	140.7767	139.2878	139.0092	137.7124	137.7124	137.4723	138.2119	139.0092	139.5728	140.1619 (39)
Average = Sum(39)m / 12 =												139.2865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2551	1.2523	1.2495	1.2362	1.2338	1.2223	1.2223	1.2201	1.2267	1.2338	1.2388	1.2440 (40)
HLP (average)												1.2362 (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	2.8299 (42)
Average daily hot water use (litres/day)	101.4110 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1595.5903 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.1536	30.7455	31.7266	27.6601	26.5405	22.9024	21.2225	24.3531	24.6439	28.7201	31.3503	34.0444 (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	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6620	22.7928	18.5363	14.0332	10.4900	8.8561	9.5693	12.4386	16.6950	21.1981	24.7414	26.3753	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3376	278.1948	270.9948	255.6671	236.3186	218.1337	205.9850	203.1279	210.3278	225.6556	245.0041	263.1890	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	47.2494	45.7523	42.6433	38.4167	35.6727	31.8089	28.5248	32.7326	34.2277	38.6023	43.5420	45.7585	(72)
Total internal gains	413.6981	412.1889	397.6236	373.5661	347.9303	324.2477	309.5282	313.7482	326.6996	350.9051	378.7366	400.7719	(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			7.2400		11.2829		0.4400		0.0000		0.7700		27.6761 (75)
Southeast			1.4400		36.7938		0.4400		0.0000		0.7700		17.9507 (77)
Southwest			8.3200		36.7938		0.4400		0.0000		0.7700		103.7150 (79)
Northwest			0.8400		11.2829		0.4400		0.0000		0.7700		3.2110 (81)
Solar gains	152.5528	270.1133	396.8318	537.3705	643.5914	657.2760	626.0524	544.0033	445.0593	305.8803	184.5915	129.3445	(83)
Total gains	566.2510	682.3022	794.4554	910.9366	991.5217	981.5237	935.5807	857.7514	771.7589	656.7854	563.3280	530.1163	(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	41.7667	41.8625	41.9567	42.4052	42.4902	42.8903	42.8903	42.9653	42.7353	42.4902	42.3187	42.1408	
alpha	3.7844	3.7908	3.7971	3.8270	3.8327	3.8594	3.8594	3.8644	3.8490	3.8327	3.8212	3.8094	
util living area	0.9966	0.9927	0.9828	0.9540	0.8833	0.7494	0.5991	0.6601	0.8684	0.9729	0.9937	0.9974	(86)
MIT	19.1849	19.3889	19.7255	20.1721	20.5769	20.8517	20.9538	20.9326	20.7119	20.1814	19.6010	19.1514	(87)
Th 2	19.8761	19.8784	19.8806	19.8911	19.8931	19.9022	19.9022	19.9039	19.8987	19.8931	19.8891	19.8850	(88)
util rest of house	0.9956	0.9906	0.9778	0.9395	0.8441	0.6642	0.4702	0.5334	0.8085	0.9618	0.9916	0.9966	(89)
MIT 2	18.2210	18.4258	18.7615	19.2065	19.5867	19.8226	19.8871	19.8793	19.7183	19.2232	18.6461	18.1942	(90)
Living area fraction	18.3442	18.5489	18.8847	19.3299	19.7133	19.9541	20.0234	20.0139	19.8453	19.3457	18.7681	18.3165	(92)
Temperature adjustment	18.3442	18.5489	18.8847	19.3299	19.7133	19.9541	20.0234	20.0139	19.8453	19.3457	18.7681	18.3165	(93)
adjusted MIT	18.3442	18.5489	18.8847	19.3299	19.7133	19.9541	20.0234	20.0139	19.8453	19.3457	18.7681	18.3165	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	562.7367	673.6172	772.0721	847.3141	829.4249	656.3443	454.2250	469.5661	621.2100	626.7399	556.9121	527.5413	(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	1986.0866	1925.7761	1743.4735	1452.7609	1113.9192	737.3274	471.4472	496.8174	794.0693	1215.7333	1628.5534	1978.5987	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1058.9723	841.4508	722.7226	435.9217	211.6638	0.0000	0.0000	0.0000	0.0000	438.2111	771.5818	1079.5867	(98)
Space heating												5560.1108	(98)
Space heating per m2												49.3486	(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													

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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1294.4968	1019.0719	1044.7893	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.7831	0.8544	0.8192	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1013.6987	870.7069	855.8661	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1259.1747	1203.0464	1114.2613	0.0000	0.0000	0.0000	0.0000 (103)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	176.7427	247.2606	192.2460	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			616.2493 (104)
Intermittency factor (Table 10b)												1.0000 (105)
Space cooling kWh	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	0.0000	0.0000	0.0000	0.0000	0.0000	44.1857	61.8151	48.0615	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												154.0623 (107)
Energy for space heating												1.3674 (108)
Energy for space cooling												49.3486 (99)
Total												1.3674 (108)
Dwelling Fabric Energy Efficiency (DFEE)												50.7160 (109)
												50.7 (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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =				0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.3258	23.6515		(27)
Heat Loss Floor 1			56.8600	0.1300	7.3918		(28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.1800	22.9266		(29a)
Main Plane	55.8100		55.8100	0.1300	7.2553		(30)
Bay Roof	1.5000		1.5000	0.1300	0.1950		(30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		66.1502		(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)							12.6831 (36)
Total fabric heat loss						(33) + (36) =	78.8333 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	132.4150	132.0916	131.7746	130.2856	130.0071	128.7103	128.7103	128.4701	129.2098	130.0071	130.5706	131.1598 (39)
Average = Sum(39)m / 12 =												130.2843 (39)
HLP	1.1752	1.1724	1.1696	1.1563	1.1539	1.1424	1.1424	1.1402	1.1468	1.1539	1.1589	1.1641 (40)
HLP (average)												1.1563 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)
Energy content (annual)										Total = Sum(45)m =		1595.5903 (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												

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	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	35.1536	30.7455	31.7266	27.6601	26.5405	22.9024	21.2225	24.3531	24.6439	28.7201	31.3503	34.0444 (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	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	141.4969	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	25.6620	22.7928	18.5363	14.0332	10.4900	8.8561	9.5693	12.4386	16.6950	21.1981	24.7414	26.3753	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	275.3376	278.1948	270.9948	255.6671	236.3186	218.1337	205.9850	203.1279	210.3278	225.6556	245.0041	263.1890	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	37.1497	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	47.2494	45.7523	42.6433	38.4167	35.6727	31.8089	28.5248	32.7326	34.2277	38.6023	43.5420	45.7585	(72)
Total internal gains	413.6981	412.1889	397.6236	373.5661	347.9303	324.2477	309.5282	313.7482	326.6996	350.9051	378.7366	400.7719	(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	7.2400	11.2829	0.6300	0.7000	0.7700	24.9651 (75)
Southeast	1.4400	36.7938	0.6300	0.7000	0.7700	16.1923 (77)
Southwest	8.3200	36.7938	0.6300	0.7000	0.7700	93.5557 (79)
Northwest	0.8400	11.2829	0.6300	0.7000	0.7700	2.8965 (81)

Solar gains	137.6096	243.6545	357.9603	484.7326	580.5487	592.8928	564.7277	490.7157	401.4637	275.9180	166.5099	116.6746	(83)
Total gains	551.3077	655.8434	755.5839	858.2987	928.4790	917.1405	874.2560	804.4638	728.1633	626.8231	545.2464	517.4464	(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	59.0893	59.2340	59.3765	60.0550	60.1837	60.7901	60.7901	60.9037	60.5551	60.1837	59.9239	59.6548	
alpha	4.9393	4.9489	4.9584	5.0037	5.0122	5.0527	5.0527	5.0602	5.0370	5.0122	4.9949	4.9770	
util living area	0.9992	0.9979	0.9939	0.9777	0.9224	0.7870	0.6204	0.6862	0.9063	0.9885	0.9983	0.9994	(86)
MIT	19.6223	19.7778	20.0367	20.3861	20.7062	20.9149	20.9800	20.9675	20.8068	20.3899	19.9426	19.5980	(87)
Th 2	19.9399	19.9422	19.9444	19.9551	19.9571	19.9664	19.9664	19.9681	19.9628	19.9571	19.9530	19.9488	(88)
util rest of house	0.9989	0.9972	0.9916	0.9683	0.8879	0.6990	0.4883	0.5551	0.8504	0.9822	0.9975	0.9992	(89)
MIT 2	18.6785	18.8356	19.0952	19.4478	19.7496	19.9250	19.9611	19.9582	19.8474	19.4566	19.0091	18.6613	(90)
Living area fraction									fLA = Living area / (4) =			0.1278	(91)
MIT	18.7991	18.9560	19.2155	19.5677	19.8718	20.0515	20.0913	20.0872	19.9701	19.5759	19.1284	18.7810	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7991	18.9560	19.2155	19.5677	19.8718	20.0515	20.0913	20.0872	19.9701	19.5759	19.1284	18.7810	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	550.4795	653.3793	747.5180	827.1434	821.1770	648.5612	441.6613	459.7802	619.5857	613.6328	543.4385	516.8822	(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	1919.8966	1856.6841	1675.5850	1389.8542	1062.3976	701.6616	449.3635	473.6965	758.4695	1166.9302	1570.5505	1912.4455	(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	1018.8463	808.6214	690.4819	405.1518	179.4682	0.0000	0.0000	0.0000	0.0000	411.6533	739.5207	1038.2991	(98)
Space heating												5292.0427	(98)
Space heating per m2										(98) / (4) =		46.9694	(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	1209.8764	952.4559	976.3728	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8256	0.8976	0.8645	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	998.8757	854.9349	844.0657	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1183.9217	1131.3682	1051.9771	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)

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Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	133.2331	205.6664	154.6861	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												493.5856 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	33.3083	51.4166	38.6715	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												123.3964 (107)
Space cooling per m2												1.0952 (108)
Energy for space heating												46.9694 (99)
Energy for space cooling												1.0952 (108)
Total												48.0646 (109)
Target Fabric Energy Efficiency (TFEE)												55.3 (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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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)	=	0.3365 (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	0.3533	0.3365	0.3365	0.3112	0.3112	0.2776	0.2860	0.2692	0.2776	0.2944	0.2944	0.3196 (22b)
Effective ac	0.5624	0.5566	0.5566	0.5484	0.5484	0.5385	0.5409	0.5362	0.5385	0.5433	0.5433	0.5511 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	50.9016	50.3764	50.3764	49.6368	49.6368	48.7402	48.9548	48.5321	48.7402	49.1757	49.1757	49.8769 (38)
Heat transfer coeff	138.7371	138.2119	138.2119	137.4723	137.4723	136.5757	136.7903	136.3676	136.5757	137.0112	137.0112	137.7124 (39)
Average = Sum(39)m / 12 =												137.3458 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2314	1.2267	1.2267	1.2201	1.2201	1.2122	1.2141	1.2103	1.2122	1.2160	1.2160	1.2223 (40)
HLP (average)												1.2190 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)												Total = Sum(45)m = 1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313 (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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411 (61)
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =												0.0000 (63)
Output from w/h	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047 (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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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			7.2400		12.9236		0.4400		0.0000		0.7700		31.7004 (75)
Southeast			1.4400		40.4699		0.4400		0.0000		0.7700		19.7441 (77)
Southwest			8.3200		40.4699		0.4400		0.0000		0.7700		114.0772 (79)
Northwest			0.8400		12.9236		0.4400		0.0000		0.7700		3.6779 (81)
Solar gains	169.1997	270.2019	393.9569	552.8837	647.4109	708.3918	667.1351	591.3025	480.0296	327.2084	209.8645	142.0049	(83)
Total gains	837.4021	933.1488	1030.6432	1148.8090	1201.2942	1224.9891	1162.2360	1095.9107	1008.3724	896.5442	824.6799	791.5211	(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	43.5793	43.7448	43.7448	43.9802	43.9802	44.2689	44.1995	44.3365	44.2689	44.1282	44.1282	43.9035
alpha	3.9053	3.9163	3.9163	3.9320	3.9320	3.9513	3.9466	3.9558	3.9513	3.9419	3.9419	3.9269
util living area	0.9858	0.9774	0.9547	0.8926	0.7606	0.5315	0.3605	0.3918	0.6925	0.9125	0.9736	0.9882 (86)
MIT	19.6222	19.7847	20.1051	20.4992	20.8139	20.9681	20.9949	20.9930	20.9059	20.5295	20.0204	19.5924 (87)
Th 2	19.8950	19.8987	19.8987	19.9039	19.9039	19.9103	19.9088	19.9117	19.9103	19.9072	19.9072	19.9022 (88)
util rest of house	0.9819	0.9713	0.9421	0.8620	0.6945	0.4266	0.2358	0.2618	0.5941	0.8803	0.9652	0.9850 (89)
MIT 2	18.0964	18.3332	18.7916	19.3398	19.7357	19.8934	19.9077	19.9102	19.8454	19.3954	18.6818	18.0584 (90)
Living area fraction	18.2914	18.5187	18.9595	19.4880	19.8735	20.0307	20.0467	20.0486	19.9809	19.5404	18.8529	18.2544 (91)
MIT	18.2914	18.5187	18.9595	19.4880	19.8735	20.0307	20.0467	20.0486	19.9809	19.5404	18.8529	18.2544 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1414	18.3687	18.8095	19.3380	19.7235	19.8807	19.8967	19.8986	19.8309	19.3904	18.7029	18.1044 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	814.6803	895.2396	953.6163	968.0512	819.4885	518.8600	272.4355	285.1316	591.0264	771.6370	785.0476	773.3042	(94)
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	1809.3296	1764.7851	1576.9294	1297.4608	924.2949	530.0130	273.1245	286.1763	632.4710	1067.3662	1466.4184	1790.8708	(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	(98a)
Space heating kWh	740.0191	584.3346	463.7450	237.1749	77.9760	0.0000	0.0000	0.0000	0.0000	220.0226	490.5869	757.0696	(98)
Space heating												3570.9285	(98)
RHI space heating demand												3571	(98)

FULL SAP CALCULATION PRINTOUT

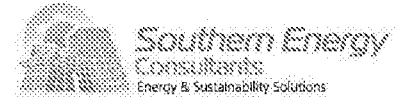
Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) =				0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	141.4171	141.0937	140.7767	139.2878	139.0092	137.7124	137.7124	137.4723	138.2119	139.0092	139.5728	140.1619 (39)
Average = Sum(39)m / 12 =												139.2865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2551	1.2523	1.2495	1.2362	1.2338	1.2223	1.2223	1.2201	1.2267	1.2338	1.2388	1.2440 (40)
HLP (average)												1.2362 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)

Regs Region: England

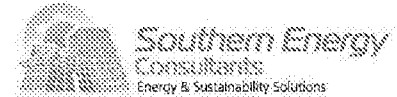
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313	(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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411	(61)
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047	(65)
Total per year (kWh/year) = Sum(64)m =												1761.3181	(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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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			7.2400		11.2829		0.4400		0.0000		0.7700		27.6761 (75)
Southeast			1.4400		36.7938		0.4400		0.0000		0.7700		17.9507 (77)
Southwest			8.3200		36.7938		0.4400		0.0000		0.7700		103.7150 (79)
Northwest			0.8400		11.2829		0.4400		0.0000		0.7700		3.2110 (81)
Solar gains	152.5528	270.1133	396.8318	537.3705	643.5914	657.2760	626.0524	544.0033	445.0593	305.8803	184.5915	129.3445	(83)
Total gains	820.7553	933.0602	1033.5181	1133.2957	1197.4747	1173.8732	1121.1533	1048.6115	973.4021	875.2161	799.4069	778.8607	(84)

7. Mean internal temperature (heating season)

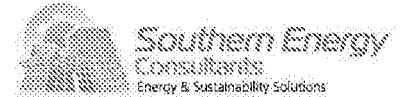
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.7534	42.8514	42.9479	43.4069	43.4939	43.9035	43.9035	43.9802	43.7448	43.4939	43.3183	43.1362	
alpha	3.8502	3.8568	3.8632	3.8938	3.8996	3.9269	3.9269	3.9320	3.9163	3.8996	3.8879	3.8757	
util living area	0.9888	0.9807	0.9630	0.9185	0.8252	0.6705	0.5172	0.5673	0.7884	0.9390	0.9810	0.9908	(86)
MIT	19.4608	19.6522	19.9602	20.3574	20.6961	20.9058	20.9739	20.9625	20.8139	20.3777	19.8483	19.4243	(87)
Th 2	19.8761	19.8784	19.8806	19.8911	19.8931	19.9022	19.9022	19.9039	19.8987	19.8931	19.8891	19.8850	(88)
util rest of house	0.9859	0.9757	0.9531	0.8955	0.7755	0.5817	0.3986	0.4474	0.7130	0.9170	0.9752	0.9884	(89)
MIT 2	17.8495	18.1278	18.5721	19.1375	19.5858	19.8329	19.8906	19.8856	19.7415	19.1783	18.4217	17.8023	(90)
Living area fraction	fLA = Living area / (4) =											0.1278	(91)
MIT	18.0554	18.3226	18.7495	19.2934	19.7277	19.9700	20.0291	20.0233	19.8785	19.3316	18.6040	18.0096	(92)
Temperature adjustment												-0.1500	
adjusted MIT	17.9054	18.1726	18.5995	19.1434	19.5777	19.8200	19.8791	19.8733	19.7285	19.1816	18.4540	17.8596	(93)

8. Space heating requirement

Utilisation	0.9781	0.9646	0.9374	0.8759	0.7589	0.5744	0.3959	0.4439	0.6993	0.8980	0.9641	0.9816	(94)
Useful gains	802.7611	900.0607	968.8380	992.6281	908.7527	674.2620	443.8994	465.4337	680.6954	785.9761	770.6967	764.5321	(95)
Ext temp.	4.3000	4.0000	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	1924.0376	1872.6870	1703.3272	1426.7813	1095.0766	718.8602	451.5718	477.4761	777.9296	1192.9184	1584.7143	1914.5517	(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	834.2297	653.6048	546.4600	312.5902	138.6249	0.0000	0.0000	0.0000	0.0000	302.7651	586.0927	855.6145	(98)
Space heating												4229.9819	(98)
Space heating per m2												(98) / (4) =	37.5431 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4674.0131 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	834.2297	653.6048	546.4600	312.5902	138.6249	0.0000	0.0000	0.0000	0.0000	302.7651	586.0927	855.6145 (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)	921.8007	722.2153	603.8232	345.4036	153.1767	0.0000	0.0000	0.0000	0.0000	334.5470	647.6162	945.4304 (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	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (64)
Efficiency of water heater (217)m	89.9162	89.8605	89.7427	89.4668	88.8694	87.3000	87.3000	87.3000	87.3000	89.4178	89.7900	87.3000 (216)
Fuel for water heating, kWh/month	199.7218	175.2242	182.0947	160.7169	156.3403	138.9748	130.4075	147.3327	148.4088	166.8956	179.5272	193.8471 (219)
Water heating fuel used												1979.4916 (219)
Annual totals kWh/year												
Space heating fuel - main system												4674.0131 (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)												453.1995 (232)
Total delivered energy for all uses												7181.7042 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4674.0131	3.4800	162.6557 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1979.4916	3.4800	68.8863 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	453.1995	13.1900	59.7770 (250)
Additional standing charges			120.0000 (251)
Total energy cost			421.2115 (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] =	1.1220 (257)
SAP value		84.3478
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4674.0131	0.2160	1009.5868 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1979.4916	0.2160	427.5702 (264)
Space and water heating			1437.1570 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total kg/year			1711.2926 (272)
CO2 emissions per m2			15.1900 (273)
EI value			85.4561
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	$3.48 / 0.8885 = 3.917$, stars = 4
Water heating environmental impact	$0.216 / 0.8885 = 0.2431$, stars = 4

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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)	=	0.3365 (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	0.3533	0.3365	0.3365	0.3112	0.3112	0.2776	0.2860	0.2692	0.2776	0.2944	0.2944	0.3196 (22b)
Effective ac	0.5624	0.5566	0.5566	0.5484	0.5484	0.5385	0.5409	0.5362	0.5385	0.5433	0.5433	0.5511 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	50.9016	50.3764	50.3764	49.6368	49.6368	48.7402	48.9548	48.5321	48.7402	49.1757	49.1757	49.8769 (38)
Heat transfer coeff	138.7371	138.2119	138.2119	137.4723	137.4723	136.5757	136.7903	136.3676	136.5757	137.0112	137.0112	137.7124 (39)
Average = Sum(39)m / 12 =												137.3458 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2314	1.2267	1.2267	1.2201	1.2201	1.2122	1.2141	1.2103	1.2122	1.2160	1.2160	1.2223 (40)
HLP (average)												1.2190 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

Energy content (annual)												Total = Sum(45)m =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313	(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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411	(61)
Total heat required for water heating calculated for each month	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
												Solar input (sum of months) = Sum(63)m =	0.0000 (63)
Output from w/h	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
												Total per year (kWh/year) = Sum(64)m =	1761.3181 (64)
Heat gains from water heating, kWh/month	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047	(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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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				7.2400	12.9236		0.4400		0.0000		0.7700		31.7004 (75)
Southeast				1.4400	40.4699		0.4400		0.0000		0.7700		19.7441 (77)
Southwest				8.3200	40.4699		0.4400		0.0000		0.7700		114.0772 (79)
Northwest				0.8400	12.9236		0.4400		0.0000		0.7700		3.6779 (81)
Solar gains	169.1997	270.2019	393.9569	552.8837	647.4109	708.3918	667.1351	591.3025	480.0296	327.2084	209.8645	142.0049	(83)
Total gains	837.4021	933.1488	1030.6432	1148.8090	1201.2942	1224.9891	1162.2360	1095.9107	1008.3724	896.5442	824.6799	791.5211	(84)

7. Mean internal temperature (heating season)

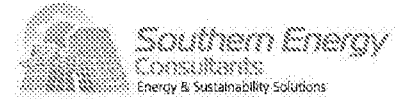
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5793	43.7448	43.7448	43.9802	43.9802	44.2689	44.1995	44.3365	44.2689	44.1282	44.1282	43.9035	
alpha	3.9053	3.9163	3.9163	3.9320	3.9320	3.9513	3.9466	3.9558	3.9513	3.9419	3.9419	3.9269	
util living area	0.9858	0.9774	0.9547	0.8926	0.7606	0.5315	0.3605	0.3918	0.6925	0.9125	0.9736	0.9882	(86)
MIT	19.6222	19.7847	20.1051	20.4992	20.8139	20.9681	20.9949	20.9930	20.9059	20.5295	20.0204	19.5924	(87)
Th 2	19.8950	19.8987	19.8987	19.9039	19.9039	19.9103	19.9088	19.9117	19.9103	19.9072	19.9072	19.9022	(88)
util rest of house	0.9819	0.9713	0.9421	0.8620	0.6945	0.4266	0.2358	0.2618	0.5941	0.8803	0.9652	0.9850	(89)
MIT 2	18.0964	18.3332	18.7916	19.3398	19.7357	19.8934	19.9077	19.9102	19.8454	19.3954	18.6818	18.0584	(90)
Living area fraction	18.2914	18.5187	18.9595	19.4880	19.8735	20.0307	20.0467	20.0486	19.9809	19.5404	18.8529	18.2544	(92)
MIT	18.2914	18.5187	18.9595	19.4880	19.8735	20.0307	20.0467	20.0486	19.9809	19.5404	18.8529	18.2544	(92)
Temperature adjustment	18.1414	18.3687	18.8095	19.3380	19.7235	19.8807	19.8967	19.8986	19.8309	19.3904	18.7029	18.1044	(93)
adjusted MIT	18.1414	18.3687	18.8095	19.3380	19.7235	19.8807	19.8967	19.8986	19.8309	19.3904	18.7029	18.1044	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9729	0.9594	0.9253	0.8427	0.6822	0.4236	0.2344	0.2602	0.5861	0.8607	0.9519	0.9770	(94)
Useful gains	814.6803	895.2396	953.6163	968.0512	819.4885	518.8600	272.4355	285.1316	591.0264	771.6370	785.0476	773.3042	(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	1809.3296	1764.7851	1576.9294	1297.4608	924.2949	530.0130	273.1245	286.1763	632.4710	1067.3662	1466.4184	1790.8708	(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	740.0191	584.3346	463.7450	237.1749	77.9760	0.0000	0.0000	0.0000	0.0000	220.0226	490.5869	757.0696	(98)
Space heating												3570.9285	(98)
Space heating per m2												(98) / (4) =	31.6937 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3945.7774 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	740.0191	584.3346	463.7450	237.1749	77.9760	0.0000	0.0000	0.0000	0.0000	220.0226	490.5869	757.0696	(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)	817.7006	645.6736	512.4254	262.0717	86.1613	0.0000	0.0000	0.0000	0.0000	243.1189	542.0850	836.5410	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498	(64)
Efficiency of water heater (217)m	89.8568	89.8013	89.6438	89.2650	88.4239	87.3000	87.3000	87.3000	87.3000	89.1789	89.6869	87.3000	(216)
Fuel for water heating, kWh/month	199.8538	175.3398	182.2956	161.0802	157.1279	138.9748	130.4075	147.3327	148.4088	167.3428	179.7336	193.9736	(219)
Water heating fuel used												1981.8710	(219)
Annual totals kWh/year													
Space heating fuel - main system												3945.7774	(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)												453.1995	(232)
Total delivered energy for all uses												6455.8479	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3945.7774	3.8700	152.7016 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1981.8710	3.8700	76.6984 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	453.1995	18.9000	85.6547 (250)
Additional standing charges			93.0000 (251)
Total energy cost			422.2297 (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	3945.7774	0.2160	852.2879 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.8710	0.2160	428.0841 (264)
Space and water heating			1280.3720 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total kg/year			1554.5076 (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	3945.7774	1.2200	4813.8484 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.8710	1.2200	2417.8826 (264)
Space and water heating			7231.7310 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	453.1995	3.0700	1391.3225 (268)
Primary energy kWh/year			8853.3035 (272)
Primary energy kWh/m2/year			78.5773 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.0	-£ 30	-192 kg (12.3%)
U Solar photovoltaic panels	+ 8.5	-£ 345	-947 kg (69.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£30	1.70 kg/m²	B 85 B 87
Solar photovoltaic panels	£345	8.40 kg/m²	A 94 A 95
Total Savings	£374	10.11 kg/m²	

Potential energy efficiency rating: A 94
Potential environmental impact rating: A 95

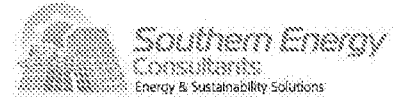
Fuel prices for cost data on this page from database revision number 470 TEST (21 Dec 2020)
Recommendation texts revision number 4.9c (22 Feb 2014)

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

	Current	Potential	Saving
Electricity	£100	£109	-£9
Mains gas	£322	£283	£39
Space heating	£260	£260	£0
Water heating	£77	£47	£30
Lighting	£86	£86	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£422	£47	£375
Total cost of uses	£423	£48	£375
Delivered energy	57 kWh/m²	33 kWh/m²	25 kWh/m²
Carbon dioxide emissions	1.6 tonnes	0.4 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	4 kg/m²	10 kg/m²
Primary energy	79 kWh/m²	19 kWh/m²	59 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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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) = 0.3365 (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	0.4290	0.4206	0.4122	0.3701	0.3617	0.3196	0.3196	0.3112	0.3365	0.3617	0.3785	0.3954 (22b)
Effective ac	0.5920	0.5884	0.5849	0.5685	0.5654	0.5511	0.5511	0.5484	0.5566	0.5654	0.5716	0.5782 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss							(33) + (36) = 87.8355 (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	53.5816	53.2582	52.9412	51.4523	51.1737	49.8769	49.8769	49.6368	50.3764	51.1737	51.7373	52.3265 (38)
Heat transfer coeff	141.4171	141.0937	140.7767	139.2878	139.0092	137.7124	137.7124	137.4723	138.2119	139.0092	139.5728	140.1619 (39)
Average = Sum(39)m / 12 =												139.2865 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2551	1.2523	1.2495	1.2362	1.2338	1.2223	1.2223	1.2201	1.2267	1.2338	1.2388	1.2440 (40)
HLP (average)												1.2362 (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	2.8299 (42)
Average daily hot water use (litres/day)	101.4110 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1595.5903 (45)										
Distribution loss (46)m = 0.15 x (45)m											
24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313 (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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669 (61)
Total heat required for water heating calculated for each month											
179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1079.5246 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											1813.6014 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.3666 (H8)
Collector performance factor											0.5851 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											101.4110 (H14)
Solar storage volume factor											0.7396 (H15)
Solar input											0.9397 (H16)
Solar input	-25.4254	-42.4277	-72.2592	-96.8416	-119.6396	-117.6248	-116.0703	-101.4112	-79.4253	-54.2382	-30.1582 (H17)
Output from w/h											
154.1568	115.0297	91.1575	46.9467	19.2991	3.7002	0.0000	27.2102	50.1355	94.9963	131.0394	153.0731 (64)
Heat gains from water heating, kWh/month											
58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047 (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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(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	7.2400	11.2829	0.4400	0.0000	0.7700	27.6761 (75)
Southeast	1.4400	36.7938	0.4400	0.0000	0.7700	17.9507 (77)
Southwest	8.3200	36.7938	0.4400	0.0000	0.7700	103.7150 (79)
Northwest	0.8400	11.2829	0.4400	0.0000	0.7700	3.2110 (81)

Solar gains	152.5528	270.1133	396.8318	537.3705	643.5914	657.2760	626.0524	544.0033	445.0593	305.8803	184.5915	129.3445 (83)
Total gains	820.7553	933.0602	1033.5181	1133.2957	1197.4747	1173.8732	1121.1533	1048.6115	973.4021	875.2161	799.4069	778.8607 (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	42.7534	42.8514	42.9479	43.4069	43.4939	43.9035	43.9035	43.9802	43.7448	43.4939	43.3183	43.1362
alpha	3.8502	3.8568	3.8632	3.8938	3.8996	3.9269	3.9269	3.9320	3.9163	3.8996	3.8879	3.8757
util living area	0.9888	0.9807	0.9630	0.9185	0.8252	0.6705	0.5172	0.5673	0.7884	0.9390	0.9810	0.9908 (86)
MIT	19.4608	19.6522	19.9602	20.3574	20.6961	20.9058	20.9739	20.9625	20.8139	20.3777	19.8483	19.4243 (87)
Th 2	19.8761	19.8784	19.8806	19.8911	19.8931	19.9022	19.9022	19.9039	19.8987	19.8931	19.8891	19.8850 (88)
util rest of house	0.9859	0.9757	0.9531	0.8955	0.7755	0.5817	0.3986	0.4474	0.7130	0.9170	0.9752	0.9884 (89)
MIT 2	17.8495	18.1278	18.5721	19.1375	19.5858	19.8329	19.8906	19.8856	19.7415	19.1783	18.4217	17.8023 (90)
Living area fraction	fLA = Living area / (4) =											0.1278 (91)
MIT	18.0554	18.3226	18.7495	19.2934	19.7277	19.9700	20.0291	20.0233	19.8785	19.3316	18.6040	18.0096 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9054	18.1726	18.5995	19.1434	19.5777	19.8200	19.8791	19.8733	19.7285	19.1816	18.4540	17.8596 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

Calculation of Energy Ratings for Improved Dwelling 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9781	0.9646	0.9374	0.8759	0.7589	0.5744	0.3959	0.4439	0.6993	0.8980	0.9641	0.9816	(94)
Useful gains	802.7611	900.0607	968.8380	992.6281	908.7527	674.2620	443.8994	465.4337	680.6954	785.9761	770.6967	764.5321	(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	1924.0376	1872.6870	1703.3272	1426.7813	1095.0766	718.8602	451.5718	477.4761	777.9296	1192.9184	1584.7143	1914.5517	(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	834.2297	653.6048	546.4600	312.5902	138.6249	0.0000	0.0000	0.0000	0.0000	302.7651	586.0927	855.6145	(98)
Space heating												4229.9819	(98)
Space heating per m2											(98) / (4) =	37.5431	(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													4674.0131 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	834.2297	653.6048	546.4600	312.5902	138.6249	0.0000	0.0000	0.0000	0.0000	302.7651	586.0927	855.6145	(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)	921.8007	722.2153	603.8232	345.4036	153.1767	0.0000	0.0000	0.0000	0.0000	334.5470	647.6162	945.4304	(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	154.1568	115.0297	91.1575	46.9467	19.2991	3.7002	0.0000	27.2102	50.1355	94.9963	131.0394	153.0731	(64)
Efficiency of water heater	89.9855	90.0063	90.0282	90.0689	90.0964	87.3000	87.3000	87.3000	87.3000	89.7146	89.8979	87.3000	(216)
(217)m	89.9855	90.0063	90.0282	90.0689	90.0964	87.3000	87.3000	87.3000	87.3000	89.7146	89.8979	89.9994	(217)
Fuel for water heating, kWh/month	171.3128	127.8019	101.2544	52.1231	21.4205	4.2385	0.0000	31.1687	57.4290	105.8872	145.7647	170.0824	(219)
Water heating fuel used												988.4831	(219)
Annual totals kWh/year													
Space heating fuel - main system												4674.0131	(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)												453.1995	(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												4513.4564	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4674.0131	3.4800	162.6557 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	988.4831	3.4800	34.3992 (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	453.1995	13.1900	59.7770 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			165.4965 (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] =	0.4408 (257)
SAP value			93.8502
SAP rating (Section 12)			94 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4674.0131	0.2160	1009.5868 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	988.4831	0.2160	213.5124 (264)
Space and water heating			1223.0992 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			626.7475 (272)
CO2 emissions per m2			5.5600 (273)
EI value			94.6734
EI rating			95 (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	56.8600 (1b)	x 2.3500 (2b)	= 133.6210 (1b) - (3b)
First floor	55.8100 (1c)	x 2.5200 (2c)	= 140.6412 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	112.6700		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 274.2622 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					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) = 0.1458 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3958 (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)	=	0.3365 (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	0.3533	0.3365	0.3365	0.3112	0.3112	0.2776	0.2860	0.2692	0.2776	0.2944	0.2944	0.3196 (22b)
Effective ac	0.5624	0.5566	0.5566	0.5484	0.5484	0.5385	0.5409	0.5362	0.5385	0.5433	0.5433	0.5511 (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)			17.8400	1.2357	22.0456		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			56.8600	0.1900	10.8034	75.0000	4264.5000 (28a)
Brick/Render Cavity	149.5100	22.1400	127.3700	0.2500	31.8425	60.0000	7642.2000 (29a)
Main Plane	55.8100		55.8100	0.1100	6.1391	9.0000	502.2900 (30)
Bay Roof	1.5000		1.5000	0.1100	0.1650	9.0000	13.5000 (30)
Total net area of external elements Aum(A, m ²)			263.6800				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.4456		(33)
Internal Wall 1			73.8800			75.0000	5541.0000 (32c)
Internal Wall 2			199.2400			9.0000	1793.1600 (32c)
Internal Floor 1			55.8100			18.0000	1004.5800 (32d)
Internal Ceiling 1			55.8100			18.0000	1004.5800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	21765.8100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1819 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.3899 (36)
Total fabric heat loss						(33) + (36) =	87.8355 (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	50.9016	50.3764	50.3764	49.6368	49.6368	48.7402	48.9548	48.5321	48.7402	49.1757	49.1757	49.8769 (38)
Heat transfer coeff	138.7371	138.2119	138.2119	137.4723	137.4723	136.5757	136.7903	136.3676	136.5757	137.0112	137.0112	137.7124 (39)
Average = Sum(39)m / 12 =												137.3458 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2314	1.2267	1.2267	1.2201	1.2201	1.2122	1.2141	1.2103	1.2122	1.2160	1.2160	1.2223 (40)
HLP (average)												1.2190 (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												2.8299 (42)
Average daily hot water use (litres/day)												101.4110 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	111.5521	107.4957	103.4392	99.3828	95.3264	91.2699	91.2699	95.3264	99.3828	103.4392	107.4957	111.5521 (44)
Energy conte	165.4286	144.6849	149.3019	130.1650	124.8964	107.7761	99.8704	114.6027	115.9715	135.1535	147.5307	160.2088 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)												Total = Sum(45)m =	1595.5903 (45)
Distribution loss (46)m = 0.15 x (45)m													
	24.8143	21.7027	22.3953	19.5247	18.7345	16.1664	14.9806	17.1904	17.3957	20.2730	22.1296	24.0313 (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	14.1536	12.7725	14.1149	13.6233	14.0423	13.5489	13.9753	14.0188	13.5894	14.0809	13.6669	14.1411 (61)	
Total heat required for water heating calculated for each month													
	179.5822	157.4574	163.4167	143.7882	138.9387	121.3250	113.8457	128.6215	129.5609	149.2345	161.1975	174.3498 (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													1.2004 (H8)
Utilisation factor													0.5653 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													101.4110 (H14)
Volume ratio Veff/V													0.7396 (H15)
Solar storage volume factor													0.9397 (H16)
Solar input													-894.5790 (H17)
Solar input	-27.5347	-41.3846	-69.6969	-96.3424	-116.0287	-122.1152	-119.1829	-106.4311	-83.0698	-56.5109	-33.4691	-22.8127 (63)	
	Solar input (sum of months) = Sum(63)m =											-894.5790 (63)	
Output from w/h	152.0475	116.0728	93.7198	47.4458	22.9100	0.0000	0.0000	22.1904	46.4910	92.7236	127.7284	151.5371 (64)	
	Total per year (kWh/year) = Sum(64)m =											872.8665 (64)	
Heat gains from water heating, kWh/month													
	58.5434	51.3009	53.1716	46.6857	45.0386	39.2228	36.7007	41.6101	41.9579	48.4588	52.4707	56.8047 (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	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	169.7963	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	64.1551	56.9820	46.3409	35.0830	26.2250	22.1402	23.9233	31.0964	41.7375	52.9954	61.8534	65.9382	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	410.9517	415.2160	404.4699	381.5927	352.7143	325.5726	307.4404	303.1760	313.9221	336.7993	365.6777	392.8194	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	54.8096	(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)	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	-113.1975	(71)
Water heating gains (Table 5)	78.6874	76.3406	71.4672	64.8412	60.5358	54.4761	49.3289	55.9275	58.2748	65.1328	72.8759	76.3504	(72)
Total internal gains	668.2024	662.9469	636.6863	595.9252	553.8833	516.5973	495.1009	504.6082	528.3427	569.3358	614.8154	649.5162	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	7.2400	12.9236	0.4400		0.0000	0.7700	31.7004 (75)
Southeast	1.4400	40.4699	0.4400		0.0000	0.7700	19.7441 (77)
Southwest	8.3200	40.4699	0.4400		0.0000	0.7700	114.0772 (79)
Northwest	0.8400	12.9236	0.4400		0.0000	0.7700	3.6779 (81)

Solar gains	169.1997	270.2019	393.9569	552.8837	647.4109	708.3918	667.1351	591.3025	480.0296	327.2084	209.8645	142.0049	(83)
Total gains	837.4021	933.1488	1030.6432	1148.8090	1201.2942	1224.9891	1162.2360	1095.9107	1008.3724	896.5442	824.6799	791.5211	(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	43.5793	43.7448	43.7448	43.9802	43.9802	44.2689	44.1995	44.3365	44.2689	44.1282	44.1282	43.9035
alpha	3.9053	3.9163	3.9163	3.9320	3.9320	3.9513	3.9466	3.9558	3.9513	3.9419	3.9419	3.9269
util living area	0.9858	0.9774	0.9547	0.8926	0.7606	0.5315	0.3605	0.3918	0.6925	0.9125	0.9736	0.9882 (86)
MIT	19.6222	19.7847	20.1051	20.4992	20.8139	20.9681	20.9949	20.9930	20.9059	20.5295	20.0204	19.5924 (87)
Th 2	19.8950	19.8987	19.8987	19.9039	19.9039	19.9103	19.9088	19.9117	19.9103	19.9072	19.9072	19.9022 (88)
util rest of house	0.9819	0.9713	0.9421	0.8620	0.6945	0.4266	0.2358	0.2618	0.5941	0.8803	0.9652	0.9850 (89)
MIT 2	18.0964	18.3332	18.7916	19.3398	19.7357	19.8934	19.9077	19.9102	19.8454	19.3954	18.6818	18.0584 (90)
Living area fraction	fLA = Living area / (4) =											0.1278 (91)
MIT	18.2914	18.5187	18.9595	19.4880	19.8735	20.0307	20.0467	20.0486	19.9809	19.5404	18.8529	18.2544 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1414	18.3687	18.8095	19.3380	19.7235	19.8807	19.8967	19.8986	19.8309	19.3904	18.7029	18.1044 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9729	0.9594	0.9253	0.8427	0.6822	0.4236	0.2344	0.2602	0.5861	0.8607	0.9519	0.9770	(94)
Useful gains	814.6803	895.2396	953.6163	968.0512	819.4885	518.8600	272.4355	285.1316	591.0264	771.6370	785.0476	773.3042	(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	1809.3296	1764.7851	1576.9294	1297.4608	924.2949	530.0130	273.1245	286.1763	632.4710	1067.3662	1466.4184	1790.8708	(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	740.0191	584.3346	463.7450	237.1749	77.9760	0.0000	0.0000	0.0000	0.0000	220.0226	490.5869	757.0696	(98)
Space heating												3570.9285	(98)
Space heating per m2											(98) / (4) =	31.6937	(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													3945.7774	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	740.0191	584.3346	463.7450	237.1749	77.9760	0.0000	0.0000	0.0000	0.0000	220.0226	490.5869	757.0696	(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)	817.7006	645.6736	512.4254	262.0717	86.1613	0.0000	0.0000	0.0000	0.0000	243.1189	542.0850	836.5410	(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	152.0475	116.0728	93.7198	47.4458	22.9100	0.0000	0.0000	22.1904	46.4910	92.7236	127.7284	151.5371	(64)	
Efficiency of water heater	89.9381	89.9536	89.9457	89.9504	89.7529	87.3000	87.3000	87.3000	87.3000	89.5271	89.8199	87.3000	(216)	
(217)m	89.9381	89.9536	89.9457	89.9504	89.7529	87.3000	87.3000	87.3000	87.3000	89.5271	89.8199	89.9501	(217)	
Fuel for water heating, kWh/month	169.0579	129.0364	104.1960	52.7466	25.5256	0.0000	0.0000	25.4186	53.2543	103.5705	142.2050	168.4680	(219)	
Water heating fuel used												973.4790	(219)	
Annual totals kWh/year														
Space heating fuel - main system												3945.7774	(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)													453.1995	(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													3673.2963	(238)

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

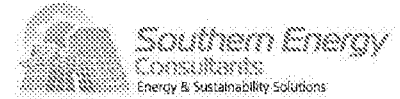
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3945.7774	3.8700	152.7016	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.4790	3.8700	37.6736	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	453.1995	18.9000	85.6547	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			47.8888	(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	3945.7774	0.2160	852.2879	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.4790	0.2160	210.2715	(264)
Space and water heating			1062.5594	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	453.1995	0.5190	235.2106	(268)
Energy saving/generation technologies				

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			415.9061 (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	3945.7774	1.2200	4813.8484 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	973.4790	1.2200	1187.6444 (264)
Space and water heating			6001.4928 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	453.1995	3.0700	1391.3225 (268)

Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			2176.3952 (272)
Primary energy kWh/m2/year			19.3165 (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	North East
Overshading	Average or unknown
Thermal mass parameter	193.2 (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	362.03 (P1)
Transmission heat loss coefficient	87.84 (37)
Summer heat loss coefficient	449.86 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North East	1.000	0.90	1.000	0.900 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
North 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	7.2400	98.8453	0.4400	0.0000	0.9000	283.3933
South East	1.4400	119.9223	0.4400	0.0000	0.9000	68.3845
South West	8.3200	119.9223	0.4400	0.0000	0.9000	395.1106
North West	0.8400	98.8453	0.4400	0.0000	0.9000	32.8799

total:						779.7683
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	Jun	Jul	Aug	
Solar gains	828	780		(P4)
Internal gains	514	492	502	
Total summer gains	1342	1272	1193	(P5)
Summer gain/loss ratio	2.98	2.83	2.65	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 193.2)	0.65	0.65	0.65	
Threshold temperature	19.63	21.37	21.10	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			