

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG003		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Ea Ga		
Property	Coniston+, Plot 2				
SAP Rating	84 B	DER	16.97	TSL	17.46
Environmental	85 B	% DER<TER	2.81		
CO ₂ Emissions (t/year)	1.57	DPEE	51.61	TPEE	56.26
General Requirements Compliance	Pass	% DPEE<TPEE	8.27		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 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) 17.46 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.97 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.3 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (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: 1.44 m², No overhang
Windows facing East: 7.24 m², No overhang
Windows facing South: 0.84 m², No overhang
Windows facing West: 8.32 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 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

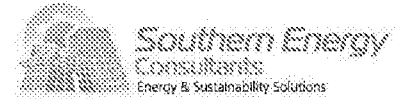
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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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
North			1.4400		10.6334		0.4400		0.0000		0.7700		5.1877 (74)
East			7.2400		19.6403		0.4400		0.0000		0.7700		48.1758 (76)
South			0.8400		46.7521		0.4400		0.0000		0.7700		13.3053 (78)
West			8.3200		19.6403		0.4400		0.0000		0.7700		55.3623 (80)
Solar gains	122.0311	234.2472	378.1624	544.9069	665.3371	680.7943	648.2126	557.8621	437.1932	275.6383	151.2709	100.9664	(83)
Total gains	570.1672	680.0243	807.6099	947.8975	1041.1305	1030.7092	981.5449	897.8052	790.9399	656.0739	562.3413	535.3301	(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	0.9968	0.9933	0.9830	0.9505	0.8720	0.7304	0.5781	0.6405	0.8636	0.9744	0.9942	0.9975 (86)
MIT	19.2194	19.4141	19.7599	20.2179	20.6160	20.8715	20.9615	20.9427	20.7297	20.1955	19.6239	19.1878 (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	0.9959	0.9914	0.9780	0.9349	0.8300	0.6431	0.4509	0.5140	0.8018	0.9636	0.9923	0.9968 (89)
MIT 2	17.4985	17.7841	18.2879	18.9496	19.4916	19.8036	19.8844	19.8743	19.6539	18.9293	18.0983	17.4580 (90)
Living area fraction	fLA = Living area / (4) =											0.1278 (91)
MIT	17.7185	17.9925	18.4760	19.1117	19.6353	19.9401	20.0221	20.0108	19.7914	19.0912	18.2933	17.6791 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.5685	17.8425	18.3260	18.9617	19.4853	19.7901	19.8721	19.8608	19.6414	18.9412	18.1433	17.5291 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9929	0.9860	0.9676	0.9172	0.8110	0.6330	0.4471	0.5085	0.7836	0.9498	0.9873	0.9944	(94)
Useful gains	566.1098	670.4906	781.4093	869.3920	844.3704	652.4438	438.8916	456.5121	619.7666	623.1356	555.2040	532.3159	(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	1876.3875	1826.0985	1664.8265	1401.4687	1082.2292	714.7442	450.6045	475.7668	765.8921	1159.5008	1541.3444	1868.2269	(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	974.8466	776.5685	657.2624	383.0952	176.9670	0.0000	0.0000	0.0000	0.0000	399.0557	710.0211	993.9178	(98)
Space heating												5071.7342	(98)
Space heating per m2												(98) / (4) =	45.0141 (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												5604.1262 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	974.8466	776.5685	657.2624	383.0952	176.9670	0.0000	0.0000	0.0000	0.0000	399.0557	710.0211	993.9178 (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)	1077.1786	858.0868	726.2568	423.3096	195.5436	0.0000	0.0000	0.0000	0.0000	440.9455	784.5537	1098.2517 (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	89.9869	89.9442	89.8442	89.6037	89.0642	87.3000	87.3000	87.3000	87.3000	89.6060	89.8904	87.3000 (216)
Fuel for water heating, kWh/month	199.5648	175.0612	181.8890	160.4714	155.9984	138.9748	130.4075	147.3327	148.4088	166.5452	179.3269	193.7056 (219)
Water heating fuel used												1977.6862 (219)
Annual totals kWh/year												
Space heating fuel - main system												5604.1262 (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												8110.0119 (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	5604.1262	0.2160	1210.4913 (261)	
Space heating - secondary	0.0000	0.0000	0.0000 (263)	
Water heating (other fuel)	1977.6862	0.2160	427.1802 (264)	
Space and water heating			1637.6715 (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			1911.8070 (272)	
Dwelling Carbon Dioxide Emission Rate (DER)			16.9700 (273)	

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

DER		16.9700 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		33.1102 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		33.1102 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 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												

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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)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 m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W			
North				1.4400	10.6334	0.6300	0.7000	0.7700	4.6796 (74)			
East				7.2400	19.6403	0.6300	0.7000	0.7700	43.4568 (76)			
South				0.8400	46.7521	0.6300	0.7000	0.7700	12.0020 (78)			
West				8.3200	19.6403	0.6300	0.7000	0.7700	49.9393 (80)			
Solar gains	110.0776	211.3016	341.1197	491.5308	600.1643	614.1074	584.7172	503.2169	394.3681	248.6383	136.4532	91.0763 (83)
Total gains	570.5811	669.4504	782.9475	906.8087	987.5622	974.9462	928.9820	854.7724	760.4139	641.4657	559.9015	537.8116 (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	0.9991	0.9978	0.9929	0.9723	0.9056	0.7575	0.5891	0.6545	0.8931	0.9873	0.9981	0.9993 (86)	
MIT	19.6382	19.7890	20.0586	20.4215	20.7378	20.9288	20.9841	20.9737	20.8228	20.4013	19.9547	19.6148 (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	0.9988	0.9970	0.9902	0.9610	0.8664	0.6671	0.4611	0.5254	0.8328	0.9805	0.9972	0.9991 (89)	
MIT 2	18.1156	18.3377	18.7323	19.2614	19.6913	19.9171	19.9603	19.9567	19.8110	19.2403	18.5880	18.0878 (90)	
Living area fraction									fLA = Living area / (4) =			0.1278 (91)	
MIT	18.3102	18.5232	18.9018	19.4096	19.8251	20.0464	20.0912	20.0867	19.9403	19.3887	18.7627	18.2829 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.3102	18.5232	18.9018	19.4096	19.8251	20.0464	20.0912	20.0867	19.9403	19.3887	18.7627	18.2829 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9980	0.9953	0.9863	0.9531	0.8604	0.6749	0.4773	0.5413	0.8311	0.9749	0.9957	0.9985 (94)
Useful gains	569.4120	666.2908	772.2001	864.2673	849.7150	657.9623	443.3635	462.6805	632.0177	625.3854	557.5045	536.9904 (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	1855.1643	1799.5130	1634.2472	1369.2556	1056.3163	701.0105	449.3496	473.6323	754.6234	1142.5875	1522.8055	1847.1165 (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	956.5997	761.5253	641.3631	363.5916	153.7114	0.0000	0.0000	0.0000	0.0000	384.7984	695.0167	974.7338 (98)
Space heating												4931.3400 (98)
Space heating per m2												(98) / (94) = 43.7680 (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													5279.8073 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	956.5997	761.5253	641.3631	363.5916	153.7114	0.0000	0.0000	0.0000	0.0000	384.7984	695.0167	974.7338	(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)	1024.1967	815.3376	686.6842	389.2844	164.5732	0.0000	0.0000	0.0000	0.0000	411.9897	744.1293	1043.6122	(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	88.3500	88.1787	87.7731	86.7961	84.7483	80.3000	80.3000	80.3000	80.3000	86.8393	87.9582	88.4197	(216)
Fuel for water heating, kWh/month	244.9207	216.2793	228.1573	206.4328	204.6927	190.2689	182.2921	203.2130	205.4572	214.3181	223.7946	238.8242	(219)
Water heating fuel used												2558.6510	(219)
Annual totals kWh/year													
Space heating fuel - main system													5279.8073 (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													8366.6579 (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	5279.8073	0.2160	1140.4384 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2558.6510	0.2160	552.6686 (264)
Space and water heating			1693.1070 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total CO2, kg/m2/year			1967.2426 (272)
Emissions per m2 for space and water heating			15.0271 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.0876 (272b)
Emissions per m2 for pumps and fans			0.3455 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.0271 * 1.00) + 2.0876 + 0.3455, rounded to 2 d.p.			17.4600 (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 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				
North				1.4400	10.6334	0.4400	0.0000	0.7700	5.1877 (74)				
East				7.2400	19.6403	0.4400	0.0000	0.7700	48.1758 (76)				
South				0.8400	46.7521	0.4400	0.0000	0.7700	13.3053 (78)				
West				8.3200	19.6403	0.4400	0.0000	0.7700	55.3623 (80)				
Solar gains	122.0311	234.2472	378.1624	544.9069	665.3371	680.7943	648.2126	557.8621	437.1932	275.6383	151.2709	100.9664	(83)
Total gains	535.7293	646.4361	775.7860	918.4730	1013.2674	1005.0420	957.7408	871.6102	763.8928	626.5434	530.0074	501.7383	(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	0.9972	0.9939	0.9841	0.9529	0.8772	0.7391	0.5881	0.6526	0.8715	0.9766	0.9949	0.9978	(86)
MIT	19.1545	19.3537	19.7079	20.1784	20.5901	20.8591	20.9566	20.9353	20.7074	20.1539	19.5681	19.1230	(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	0.9964	0.9922	0.9795	0.9381	0.8367	0.6531	0.4604	0.5262	0.8124	0.9668	0.9932	0.9972	(89)
MIT 2	18.1907	18.3909	18.7443	19.2124	19.5977	19.8271	19.8881	19.8804	19.7149	19.1969	18.6134	18.1658	(90)
Living area fraction	18.3139	18.5140	18.8674	19.3358	19.7245	19.9590	20.0247	20.0153	19.8417	19.3193	18.7354	18.2882	(92)
Temperature adjustment	18.3139	18.5140	18.8674	19.3358	19.7245	19.9590	20.0247	20.0153	19.8417	19.3193	18.7354	18.2882	(93)
adjusted MIT	18.3139	18.5140	18.8674	19.3358	19.7245	19.9590	20.0247	20.0153	19.8417	19.3193	18.7354	18.2882	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	532.9566	639.4896	755.3869	852.9780	840.3569	661.3796	455.5590	470.9336	617.7001	601.3721	525.0370	499.7099	(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	1981.8026	1920.8480	1741.0452	1453.5860	1115.4820	738.0045	471.6236	496.9982	793.5744	1212.0573	1623.9919	1974.6261	(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	1077.9415	861.0728	733.3298	432.4377	204.6931	0.0000	0.0000	0.0000	0.0000	454.3498	791.2476	1097.3376	(98)
Space heating													5652.4099 (98)
Space heating per m2													(98) / (4) = 50.1678 (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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

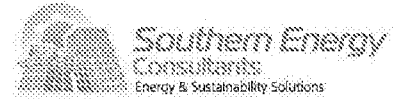


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	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	0.7918	0.8612	0.8245	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1024.9751	877.6751	861.4192	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1286.6637	1228.9478	1130.4599	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	188.4158	261.3469	200.1663	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			649.9290 (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	47.1039	65.3367	50.0416	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												162.4822 (107)
Energy for space heating												1.4421 (108)
Energy for space cooling												50.1678 (99)
Total												1.4421 (108)
Dwelling Fabric Energy Efficiency (DFEE)												51.6099 (109)
												51.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	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 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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	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
North	1.4400	10.6334	0.6300	0.7000	0.7700	4.6796 (74)
East	7.2400	19.6403	0.6300	0.7000	0.7700	43.4568 (76)
South	0.8400	46.7521	0.6300	0.7000	0.7700	12.0020 (78)
West	8.3200	19.6403	0.6300	0.7000	0.7700	49.9393 (80)

Solar gains	110.0776	211.3016	341.1197	491.5308	600.1643	614.1074	584.7172	503.2169	394.3681	248.6383	136.4532	91.0763	(83)
Total gains	523.7758	623.4905	738.7433	865.0969	948.0946	938.3551	894.2454	816.9651	721.0677	599.5434	515.1898	491.8482	(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	0.9994	0.9984	0.9945	0.9770	0.9169	0.7761	0.6087	0.6781	0.9091	0.9905	0.9987	0.9996	(86)
MIT	19.5995	19.7513	20.0232	20.3911	20.7170	20.9203	20.9816	20.9692	20.8031	20.3684	19.9178	19.5767	(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	0.9992	0.9978	0.9923	0.9673	0.8809	0.6871	0.4780	0.5475	0.8542	0.9852	0.9981	0.9994	(89)
MIT 2	18.6557	18.8091	19.0818	19.4526	19.7586	19.9280	19.9615	19.9588	19.8447	19.4358	18.9843	18.6401	(90)
Living area fraction									fLA = Living area / (4) =			0.1278	(91)
MIT	18.7764	18.9295	19.2021	19.5726	19.8811	20.0548	20.0919	20.0879	19.9672	19.5550	19.1036	18.7598	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.7764	18.9295	19.2021	19.5726	19.8811	20.0548	20.0919	20.0879	19.9672	19.5550	19.1036	18.7598	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	523.1482	621.6021	731.5379	832.8105	832.1297	652.7414	442.4205	460.6722	616.1699	588.8993	513.8534	491.4211	(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	1916.8872	1853.1831	1673.8172	1390.4816	1063.5953	702.0944	449.4439	473.7895	758.1014	1164.2105	1567.3224	1909.6645	(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	1036.9418	827.6225	701.0558	401.5232	172.2104	0.0000	0.0000	0.0000	0.0000	428.0315	758.4976	1055.1731	(98)
Space heating												5381.0559	(98)
Space heating per m ²										(98) / (4) =		47.7594	(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	0.8344	0.9038	0.8696	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1009.5010	860.8420	849.0288	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1208.7180	1154.7325	1066.5890	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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Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	143.4362	218.6545	161.8648	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												523.9555 (104)
Cooled fraction									fC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	35.8591	54.6636	40.4662	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												130.9889 (107)
Space cooling per m2												1.1626 (108)
Energy for space heating												47.7594 (99)
Energy for space cooling												1.1626 (108)
Total												48.9220 (109)
Target Fabric Energy Efficiency (TFEE)												56.3 (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 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	
North					1.4400	11.9814	0.4400	0.0000	0.7700		5.8454 (74)	
East					7.2400	22.3313	0.4400	0.0000	0.7700		54.7768 (76)	
South					0.8400	50.9848	0.4400	0.0000	0.7700		14.5099 (78)	
West					8.3200	22.3313	0.4400	0.0000	0.7700		62.9479 (80)	

Solar gains	138.0799	238.6212	380.3697	564.0425	670.1803	733.5302	691.0062	608.6932	476.4229	299.7917	175.3906	113.1133 (83)
Total gains	806.2823	901.5681	1017.0560	1159.9677	1224.0636	1250.1274	1186.1071	1113.3015	1004.7656	869.1275	790.2060	762.6295 (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	0.9875	0.9798	0.9565	0.8899	0.7525	0.5223	0.3535	0.3860	0.6941	0.9195	0.9770	0.9896 (86)
MIT	19.5930	19.7560	20.0939	20.5061	20.8212	20.9700	20.9953	20.9934	20.9051	20.5105	19.9894	19.5650 (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	0.9840	0.9743	0.9442	0.8589	0.6858	0.4186	0.2311	0.2578	0.5958	0.8891	0.9696	0.9867 (89)
MIT 2	18.0543	18.2922	18.7761	19.3486	19.7432	19.8944	19.9078	19.9103	19.8447	19.3712	18.6381	18.0186 (90)
Living area fraction	18.2509	18.4793	18.9445	19.4966	19.8810	20.0319	20.0468	20.0487	fLA = Living area / (4) =	19.5168	18.8108	0.1278 (91)
MIT	18.2509	18.4793	18.9445	19.4966	19.8810	20.0319	20.0468	20.0487	19.9802	19.5168	18.8108	18.2163 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1009	18.3293	18.7945	19.3466	19.7310	19.8819	19.8968	19.8987	19.8302	19.3668	18.6608	18.0663 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9757	0.9631	0.9277	0.8396	0.6739	0.4157	0.2297	0.2562	0.5877	0.8695	0.9572	0.9794	(94)
Ext temp.	786.6915	868.2673	943.4881	973.9154	824.8930	519.7270	272.4994	285.2057	590.5379	755.7062	756.3824	746.9215	(95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000	(96)
Month fracti	1803.7080	1759.3377	1574.8623	1298.6399	925.3245	530.1753	273.1393	286.1929	632.3790	1064.1409	1460.6455	1785.6173	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(98a)
Space heating	756.6602	598.7993	469.7424	233.8016	74.7210	0.0000	0.0000	0.0000	0.0000	229.4754	507.0694	772.7897	(97a)
RHI space heating demand												3643.0591	(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	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 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	
North					1.4400	10.6334	0.4400	0.0000	0.7700		5.1877 (74)	
East					7.2400	19.6403	0.4400	0.0000	0.7700		48.1758 (76)	
South					0.8400	46.7521	0.4400	0.0000	0.7700		13.3053 (78)	
West					8.3200	19.6403	0.4400	0.0000	0.7700		55.3623 (80)	
Solar gains	122.0311	234.2472	378.1624	544.9069	665.3371	680.7943	648.2126	557.8621	437.1932	275.6383	151.2709	100.9664 (83)
Total gains	790.2336	897.1941	1014.8487	1140.8321	1219.2204	1197.3915	1143.3135	1062.4703	965.5359	844.9741	766.0863	750.4827 (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	0.9901	0.9830	0.9650	0.9170	0.8185	0.6612	0.5085	0.5612	0.7916	0.9449	0.9835	0.9919	(86)
MIT	19.4319	19.6193	19.9443	20.3627	20.7059	20.9104	20.9754	20.9639	20.8109	20.3543	19.8176	19.3972	(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	0.9875	0.9785	0.9555	0.8937	0.7679	0.5724	0.3913	0.4421	0.7167	0.9245	0.9784	0.9897	(89)
MIT 2	17.8076	18.0806	18.5498	19.1444	19.5970	19.8367	19.8914	19.8864	19.7385	19.1470	18.3778	17.7629	(90)
Living area fraction	18.0152	18.2773	18.7280	19.3001	19.7387	19.9739	20.0299	20.0241	19.8755	19.3013	18.5618	17.9717	(91)
MIT	18.0152	18.2773	18.7280	19.3001	19.7387	19.9739	20.0299	20.0241	19.8755	19.3013	18.5618	17.9717	(92)
Temperature adjustment	17.8652	18.1273	18.5780	19.1501	19.5887	19.8239	19.8799	19.8741	19.7255	19.1513	18.4118	17.8217	(93)
adjusted MIT	17.8652	18.1273	18.5780	19.1501	19.5887	19.8239	19.8799	19.8741	19.7255	19.1513	18.4118	17.8217	(93)

8. Space heating requirement

Utilisation	0.9804	0.9683	0.9402	0.8741	0.7517	0.5655	0.3888	0.4386	0.7028	0.9059	0.9681	0.9836	(94)
Useful gains	774.7417	868.7471	954.1979	997.2089	916.5244	677.1219	444.4875	466.0331	678.5674	765.4880	741.6668	738.1410	(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	1918.3538	1866.2848	1700.3044	1427.7192	1096.6083	719.3944	451.6854	477.5907	777.5159	1188.7067	1578.8228	1909.2497	(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	850.8474	670.3453	555.1032	309.9674	133.9824	0.0000	0.0000	0.0000	0.0000	314.8747	602.7523	871.3049	(98)
Space heating												4309.1777	(98)
Space heating per m2												(98) / (4) =	38.2460 (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													4761.5223 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	850.8474	670.3453	555.1032	309.9674	133.9824	0.0000	0.0000	0.0000	0.0000	314.8747	602.7523	871.3049	(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)	940.1628	740.7130	613.3737	342.5055	148.0469	0.0000	0.0000	0.0000	0.0000	347.9278	666.0247	962.7678	(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	89.9255	89.8734	89.7518	89.4609	88.8422	87.3000	87.3000	87.3000	87.3000	89.4457	89.8054	87.3000	(216)
(217)m	89.9255	89.8734	89.7518	89.4609	88.8422	87.3000	87.3000	87.3000	87.3000	89.4457	89.8054	89.9502	(217)
Fuel for water heating, kWh/month	199.7010	175.1992	182.0763	160.7275	156.3882	138.9748	130.4075	147.3327	148.4088	166.8436	179.4965	193.8292	(219)
Water heating fuel used												1979.3852	(219)
Annual totals kWh/year													
Space heating fuel - main system												4761.5223	(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												7269.1071	(238)

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost	
	kWh/year	p/kWh	£/year	
Space heating - main system 1	4761.5223	3.4800	165.7010	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1979.3852	3.4800	68.8826	(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			424.2531	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200	(256)
Energy cost factor (ECF)	1.1301	(257)
SAP value	84.2348	
SAP rating (Section 12)	84	(258)
SAP band	B	

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

	Energy	Emission factor	Emissions	
	kWh/year	kg CO2/kWh	kg CO2/year	
Space heating - main system 1	4761.5223	0.2160	1028.4888	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1979.3852	0.2160	427.5472	(264)
Space and water heating			1456.0360	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	453.1995	0.5190	235.2106	(268)
Total kg/year			1730.1716	(272)
CO2 emissions per m2			15.3600	(273)
EI value			85.2957	
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	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 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	
North					1.4400	11.9814	0.4400	0.0000	0.7700		5.8454 (74)	
East					7.2400	22.3313	0.4400	0.0000	0.7700		54.7768 (76)	
South					0.8400	50.9848	0.4400	0.0000	0.7700		14.5099 (78)	
West					8.3200	22.3313	0.4400	0.0000	0.7700		62.9479 (80)	
Solar gains	138.0799	238.6212	380.3697	564.0425	670.1803	733.5302	691.0062	608.6932	476.4229	299.7917	175.3906	113.1133 (83)
Total gains	806.2823	901.5681	1017.0560	1159.9677	1224.0636	1250.1274	1186.1071	1113.3015	1004.7656	869.1275	790.2060	762.6295 (84)

7. Mean internal temperature (heating season)

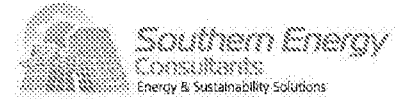
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5793	43.7448	43.7448	43.9802	43.9802	44.2689	44.1995	44.3365	44.2689	44.1282	44.1282	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	0.9875	0.9798	0.9565	0.8899	0.7525	0.5223	0.3535	0.3860	0.6941	0.9195	0.9770	0.9896	(86)
MIT	19.5930	19.7560	20.0939	20.5061	20.8212	20.9700	20.9953	20.9934	20.9051	20.5105	19.9894	19.5650	(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	0.9840	0.9743	0.9442	0.8589	0.6858	0.4186	0.2311	0.2578	0.5958	0.8891	0.9696	0.9867	(89)
MIT 2	18.0543	18.2922	18.7761	19.3486	19.7432	19.8944	19.9078	19.9103	19.8447	19.3712	18.6381	18.0186	(90)
Living area fraction	18.2509	18.4793	18.9445	19.4966	19.8810	20.0319	20.0468	20.0487	19.9802	19.5168	18.8108	18.2163	(91)
MIT	18.2509	18.4793	18.9445	19.4966	19.8810	20.0319	20.0468	20.0487	19.9802	19.5168	18.8108	18.2163	(92)
Temperature adjustment	18.1009	18.3293	18.7945	19.3466	19.7310	19.8819	19.8968	19.8987	19.8302	19.3668	18.6608	18.0663	(93)
adjusted MIT	18.1009	18.3293	18.7945	19.3466	19.7310	19.8819	19.8968	19.8987	19.8302	19.3668	18.6608	18.0663	(93)

8. Space heating requirement

Utilisation	0.9757	0.9631	0.9277	0.8396	0.6739	0.4157	0.2297	0.2562	0.5877	0.8695	0.9572	0.9794	(94)
Useful gains	786.6915	868.2673	943.4881	973.9154	824.8930	519.7270	272.4994	285.2057	590.5379	755.7062	756.3824	746.9215	(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	1803.7080	1759.3377	1574.8623	1298.6399	925.3245	530.1753	273.1393	286.1929	632.3790	1064.1409	1460.6455	1785.6173	(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	756.6602	598.7993	469.7424	233.8016	74.7210	0.0000	0.0000	0.0000	0.0000	229.4754	507.0694	772.7897	(98)
Space heating												3643.0591	(98)
Space heating per m2												(98) / (4) =	32.3339 (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													4025.4796 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	756.6602	598.7993	469.7424	233.8016	74.7210	0.0000	0.0000	0.0000	0.0000	229.4754	507.0694	772.7897	(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)	836.0887	661.6567	519.0524	258.3444	82.5647	0.0000	0.0000	0.0000	0.0000	253.5640	560.2977	853.9113	(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	89.8681	89.8145	89.6518	89.2541	88.3930	87.3000	87.3000	87.3000	87.3000	89.2114	89.7068	87.3000	(216)
Fuel for water heating, kWh/month	199.8285	175.3139	182.2793	161.0998	157.1828	138.9748	130.4075	147.3327	148.4088	167.2818	179.6937	193.9516	(219)
Water heating fuel used												1981.7553	(219)
Annual totals kWh/year													
Space heating fuel - main system												4025.4796	(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												6535.4345	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4025.4796	3.8700	155.7861 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1981.7553	3.8700	76.6939 (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			425.3097 (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	4025.4796	0.2160	869.5036 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.7553	0.2160	428.0591 (264)
Space and water heating			1297.5628 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	453.1995	0.5190	235.2106 (268)
Total kg/year			1571.6983 (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	4025.4796	1.2200	4911.0852 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1981.7553	1.2200	2417.7415 (264)
Space and water heating			7328.8267 (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			8950.3992 (272)
Primary energy kWh/m2/year			79.4391 (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 (12.2%)
U Solar photovoltaic panels	+ 8.5	-£ 345	-947 kg (68.6%)

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	£325	£286	£39
Space heating	£263	£263	£0
Water heating	£77	£47	£30
Lighting	£86	£86	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£425	£50	£375
Total cost of uses	£426	£51	£375
Delivered energy	58 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	20 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	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 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	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													1079.5246 (H5)
Overshading factor													0.8000 (H6)
Solar energy available													1813.6014 (H7)
Adjustment factor for showers													1.0000 (H7a)
Solar-to-load ratio													1.1366 (H8)
Utilisation factor													0.5851 (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													-876.7982 (H17)
Solar input	-25.4254	-42.4277	-72.2592	-96.8416	-119.6396	-117.6248	-116.0703	-101.4112	-79.4253	-54.2382	-30.1582	-21.2767 (63)	
	Solar input (sum of months) = Sum(63)m =											-876.7982 (63)	
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)	
	Total per year (kWh/year) = Sum(64)m =											886.7445 (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
North	1.4400	10.6334	0.4400	0.0000	0.7700	5.1877 (74)
East	7.2400	19.6403	0.4400	0.0000	0.7700	48.1758 (76)
South	0.8400	46.7521	0.4400	0.0000	0.7700	13.3053 (78)
West	8.3200	19.6403	0.4400	0.0000	0.7700	55.3623 (80)

Solar gains	122.0311	234.2472	378.1624	544.9069	665.3371	680.7943	648.2126	557.8621	437.1932	275.6383	151.2709	100.9664	(83)
Total gains	790.2336	897.1941	1014.8487	1140.8321	1219.2204	1197.3915	1143.3135	1062.4703	965.5359	844.9741	766.0863	750.4827	(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	0.9901	0.9830	0.9650	0.9170	0.8185	0.6612	0.5085	0.5612	0.7916	0.9449	0.9835	0.9919 (86)
MIT	19.4319	19.6193	19.9443	20.3627	20.7059	20.9104	20.9754	20.9639	20.8109	20.3543	19.8176	19.3972 (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	0.9875	0.9785	0.9555	0.8937	0.7679	0.5724	0.3913	0.4421	0.7167	0.9245	0.9784	0.9897 (89)
MIT 2	17.8076	18.0806	18.5498	19.1444	19.5970	19.8367	19.8914	19.8864	19.7385	19.1470	18.3778	17.7629 (90)
Living area fraction	fLA = Living area / (4) =											0.1278 (91)
MIT	18.0152	18.2773	18.7280	19.3001	19.7387	19.9739	20.0299	20.0241	19.8755	19.3013	18.5618	17.9717 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.8652	18.1273	18.5780	19.1501	19.5887	19.8239	19.8799	19.8741	19.7255	19.1513	18.4118	17.8217 (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	0.9804	0.9683	0.9402	0.8741	0.7517	0.5655	0.3888	0.4386	0.7028	0.9059	0.9681	0.9836	(94)
Useful gains	774.7417	868.7471	954.1979	997.2089	916.5244	677.1219	444.4875	466.0331	678.5674	765.4880	741.6668	738.1410	(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	1918.3538	1866.2848	1700.3044	1427.7192	1096.6083	719.3944	451.6854	477.5907	777.5159	1188.7067	1578.8228	1909.2497	(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	850.8474	670.3453	555.1032	309.9674	133.9824	0.0000	0.0000	0.0000	0.0000	314.8747	602.7523	871.3049	(98)
Space heating												4309.1777	(98)
Space heating per m2											(98) / (4) =	38.2460	(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													4761.5223 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	850.8474	670.3453	555.1032	309.9674	133.9824	0.0000	0.0000	0.0000	0.0000	314.8747	602.7523	871.3049	(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)	940.1628	740.7130	613.3737	342.5055	148.0469	0.0000	0.0000	0.0000	0.0000	347.9278	666.0247	962.7678	(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	89.9940	90.0167	90.0345	90.0658	90.0843	87.3000	87.3000	87.3000	87.3000	89.7376	89.9115	87.3000	(216)
(217)m	171.2967	127.7871	101.2473	52.1249	21.4234	4.2385	0.0000	31.1687	57.4290	105.8601	145.7427	170.0680	(219)
Fuel for water heating, kWh/month												988.3863	(219)
Water heating fuel used													
Annual totals kWh/year													
Space heating fuel - main system												4761.5223	(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												4600.8687	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4761.5223	3.4800	165.7010	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	988.3863	3.4800	34.3958	(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			168.5385	(255)

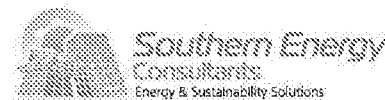
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200	(256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.4490	(257)
SAP value		93.7371	
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	4761.5223	0.2160	1028.4888	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	988.3863	0.2160	213.4914	(264)
Space and water heating			1241.9803	(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			645.6286	(272)
CO2 emissions per m2			5.7300	(273)
EI value			94.5130	
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 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	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	1.4400	11.9814	0.4400	0.0000	0.7700	5.8454 (74)
East	7.2400	22.3313	0.4400	0.0000	0.7700	54.7768 (76)
South	0.8400	50.9848	0.4400	0.0000	0.7700	14.5099 (78)
West	8.3200	22.3313	0.4400	0.0000	0.7700	62.9479 (80)

Solar gains	138.0799	238.6212	380.3697	564.0425	670.1803	733.5302	691.0062	608.6932	476.4229	299.7917	175.3906	113.1133	(83)
Total gains	806.2823	901.5681	1017.0560	1159.9677	1224.0636	1250.1274	1186.1071	1113.3015	1004.7656	869.1275	790.2060	762.6295	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9a, 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	0.9875	0.9798	0.9565	0.8899	0.7525	0.5223	0.3535	0.3860	0.6941	0.9195	0.9770	0.9896 (86)
MIT	19.5930	19.7560	20.0939	20.5061	20.8212	20.9700	20.9953	20.9934	20.9051	20.5105	19.9894	19.5650 (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	0.9840	0.9743	0.9442	0.8589	0.6858	0.4186	0.2311	0.2578	0.5958	0.8891	0.9696	0.9867 (89)
MIT 2	18.0543	18.2922	18.7761	19.3486	19.7432	19.8944	19.9078	19.9103	19.8447	19.3712	18.6381	18.0186 (90)
Living area fraction	fLA = Living area / (4) =											0.1278 (91)
MIT	18.2509	18.4793	18.9445	19.4966	19.8810	20.0319	20.0468	20.0487	19.9802	19.5168	18.8108	18.2163 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1009	18.3293	18.7945	19.3466	19.7310	19.8819	19.8968	19.8987	19.8302	19.3668	18.6608	18.0663 (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	0.9757	0.9631	0.9277	0.8396	0.6739	0.4157	0.2297	0.2562	0.5877	0.8695	0.9572	0.9794	(94)
Useful gains	786.6915	868.2673	943.4881	973.9154	824.8930	519.7270	272.4994	285.2057	590.5379	755.7062	756.3824	746.9215	(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	1803.7080	1759.3377	1574.8623	1298.6399	925.3245	530.1753	273.1393	286.1929	632.3790	1064.1409	1460.6455	1785.6173	(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	756.6602	598.7993	469.7424	233.8016	74.7210	0.0000	0.0000	0.0000	0.0000	229.4754	507.0694	772.7897	(98)
Space heating												3643.0591	(98)
Space heating per m2											(98) / (4) =	32.3339	(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													4025.4796 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	756.6602	598.7993	469.7424	233.8016	74.7210	0.0000	0.0000	0.0000	0.0000	229.4754	507.0694	772.7897	(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)	836.0887	661.6567	519.0524	258.3444	82.5647	0.0000	0.0000	0.0000	0.0000	253.5640	560.2977	853.9113	(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	89.9483	89.9646	89.9516	89.9438	89.7282	87.3000	87.3000	87.3000	87.3000	89.5553	89.8374	87.3000	(216)
(217)m	89.9483	89.9646	89.9516	89.9438	89.7282	87.3000	87.3000	87.3000	87.3000	89.5553	89.8374	89.9594	(217)
Fuel for water heating, kWh/month	169.0387	129.0206	104.1892	52.7505	25.5327	0.0000	0.0000	25.4186	53.2543	103.5378	142.1773	168.4506	(219)
Water heating fuel used												973.3703	(219)
Annual totals kWh/year													
Space heating fuel - main system												4025.4796	(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												3752.8898	(238)

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

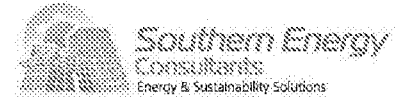
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	4025.4796	3.8700	155.7861	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	973.3703	3.8700	37.6694	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	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			50.9690	(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	4025.4796	0.2160	869.5036	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	973.3703	0.2160	210.2480	(264)
Space and water heating			1079.7516	(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			433.0983 (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	4025.4796	1.2200	4911.0852 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	973.3703	1.2200	1187.5117 (264)
Space and water heating			6098.5969 (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			2273.4993 (272)
Primary energy kWh/m2/year			20.1784 (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	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	0.000	1.000	None
East	0.000	1.000	None
South	0.000	1.000	None
West	0.000	1.000	None

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	1.4400	81.1852	0.4400	0.0000	0.9000	46.2950
East	7.2400	117.5071	0.4400	0.0000	0.9000	336.8975
South	0.8400	112.2060	0.4400	0.0000	0.9000	37.3242
West	8.3200	117.5071	0.4400	0.0000	0.9000	387.1529

total: 807.6696

	Jun	Jul	Aug	
Solar gains	857	808	711	(P4)
Internal gains	514	492	502	
Total summer gains	1371	1300	1213	(P5)
Summer gain/loss ratio	3.05	2.89	2.70	(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	19.70	21.44	21.14	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			