

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG005h		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Br Re Ea Ga		
Property	Lockwood Corner, Plot 69				
SAP Rating	84 B	DER	17.79	TET	18.17
Environmental	85 B	% DER<TER	2.07		
CO ₂ Emissions (t/year)	1.35	DPEE	51.01	TPEE	54.72
General Requirements Compliance	Pass	% DPEE<TPEE	6.78		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 92 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.17 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.79 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)54.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.0 kWh/m²/yrOK

2 Fabric U-values

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

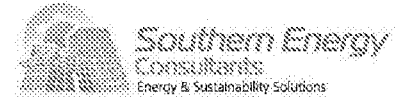
Overshading: Average
Windows facing North: 0.48 m², No overhang
Windows facing East: 5.16 m², No overhang
Windows facing South: 6.97 m², No overhang
Windows facing West: 3.93 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					40.0000 / (5) = 0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =		0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298 (22b)
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.5528	44.2437	43.9407	42.5176	42.2513	41.0119	41.0119	40.7823	41.4893	42.2513	42.7900	43.3531 (38)
Heat transfer coeff	123.9763	123.6672	123.3642	121.9411	121.6749	120.4354	120.4354	120.2059	120.9128	121.6749	122.2135	122.7766 (39)
Average = Sum(39)m / 12 =												121.9399 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3532	1.3498	1.3465	1.3309	1.3280	1.3145	1.3145	1.3120	1.3197	1.3280	1.3339	1.3401 (40)
HLP (average)												1.3309 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (65)
Total per year (kWh/year) = Sum(64)m = 1692.8195 (64)											

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0274	19.5645	15.9109	12.0456	9.0042	7.6018	8.2140	10.6768	14.3304	18.1957	21.2371	22.6396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0267	244.5382	238.2094	224.7360	207.7283	191.7434	181.0646	178.5531	184.8819	198.3553	215.3630	231.3479	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	405.2814	403.0836	388.4352	364.7507	340.5809	317.3937	302.4005	308.6676	320.8965	344.8027	372.2646	392.9778	(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				0.4800	10.6334	0.4400	0.0000			0.7700			1.7292 (74)
East				5.1600	19.6403	0.4400	0.0000			0.7700			34.3353 (76)
South				6.9700	46.7521	0.4400	0.0000			0.7700			110.4020 (78)
West				3.9300	19.6403	0.4400	0.0000			0.7700			26.1507 (80)
Solar gains	172.6172	302.4381	430.7971	553.5256	631.7020	630.5966	606.6457	548.9090	473.9802	339.3550	208.4162	146.5798	(83)
Total gains	577.8986	705.5217	819.2323	918.2763	972.2829	947.9903	909.0462	857.5766	794.8767	684.1577	580.6808	539.5576	(84)

7. Mean internal temperature (heating season)

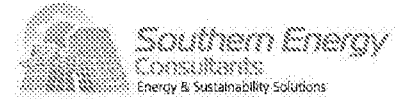
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6597	39.7589	39.8565	40.3216	40.4099	40.8258	40.8258	40.9037	40.6646	40.4099	40.2318	40.0473
alpha	3.6440	3.6506	3.6571	3.6881	3.6940	3.7217	3.7217	3.7269	3.7110	3.6940	3.6821	3.6698
util living area	0.9931	0.9853	0.9680	0.9263	0.8422	0.7002	0.5475	0.5937	0.8064	0.9498	0.9873	0.9946 (86)
MIT	19.2108	19.4495	19.8078	20.2494	20.6241	20.8711	20.9612	20.9472	20.7672	20.2601	19.6489	19.1705 (87)
Th 2	19.7994	19.8020	19.8046	19.8167	19.8189	19.8295	19.8295	19.8314	19.8254	19.8189	19.8144	19.8096 (88)
util rest of house	0.9912	0.9812	0.9589	0.9044	0.7932	0.6074	0.4173	0.4641	0.7303	0.9304	0.9831	0.9931 (89)
MIT 2	17.4376	17.7858	18.3040	18.9357	19.4375	19.7342	19.8125	19.8059	19.6282	18.9648	18.0860	17.3852 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	17.7771	18.1043	18.5919	19.1872	19.6647	19.9518	20.0324	20.0244	19.8463	19.2127	18.3852	17.7270 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6271	17.9543	18.4419	19.0372	19.5147	19.8018	19.8824	19.8744	19.6963	19.0627	18.2352	17.5770 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Utilisation	0.9857	0.9720	0.9445	0.8857	0.7781	0.6050	0.4236	0.4693	0.7203	0.9131	0.9746	0.9886	(94)	
Useful gains	569.6616	685.7535	773.7470	813.3399	756.5364	573.5167	385.0439	402.4702	572.5212	624.7312	565.9405	533.4291	(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	1652.2464	1614.3889	1473.2055	1236.1413	950.8471	626.4851	395.3188	417.6447	676.6605	1029.7021	1360.8737	1642.3817	(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	805.4430	624.0430	520.3971	304.4170	144.5672	0.0000	0.0000	0.0000	0.0000	301.2984	572.3519	825.0607	(98)	
Space heating												4097.5784	(98)	
Space heating per m2												(98) / (4) =	44.7236	(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												4527.7109 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	805.4430	624.0430	520.3971	304.4170	144.5672	0.0000	0.0000	0.0000	0.0000	301.2984	572.3519	825.0607 (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)	889.9923	689.5503	575.0244	336.3723	159.7427	0.0000	0.0000	0.0000	0.0000	332.9264	632.4331	911.6693 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Efficiency of water heater	89.9187	89.8574	89.7376	89.4760	88.9345	87.3000	87.3000	87.3000	87.3000	89.4426	89.7990	87.3000 (216)
(217)m	89.9187	89.8574	89.7376	89.4760	88.9345	87.3000	87.3000	87.3000	87.3000	89.4426	89.7990	89.9437 (217)
Fuel for water heating, kWh/month	191.8261	168.3248	174.9660	154.4473	150.1905	133.6702	125.4920	141.6911	142.6987	160.3655	172.4633	186.2042 (219)
Water heating fuel used												1902.3395 (219)
Annual totals kWh/year												
Space heating fuel - main system												4527.7109 (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)												389.0105 (232)
Total delivered energy for all uses												6894.0609 (238)

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

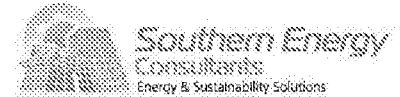
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4527.7109	0.2160	977.9856 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1902.3395	0.2160	410.9053 (264)
Space and water heating			1388.8909 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.0105	0.5190	201.8964 (268)
Total CO2, kg/year			1629.7123 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.7900 (273)

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

DER		17.7900 ZC1
Total Floor Area	TFA	91.6200
Assumed number of occupants	N	2.6473
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		15.6538 ZC2
CO2 emissions from cooking, equation (L16)		1.9923 ZC3
Total CO2 emissions		35.4361 ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000 ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000 ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000 ZC7
Net CO2 emissions		35.4361 ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
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First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1353 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3853 (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) =	0.3275 (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	0.4175	0.4094	0.4012	0.3602	0.3520	0.3111	0.3111	0.3029	0.3275	0.3520	0.3684	0.3848 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5536	0.5620	0.5679	0.5740 (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)			16.5400	1.3258	21.9280		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.1800	20.5920		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)
Bay Roof/GRP	0.5300		0.5300	0.1300	0.0689		(30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		59.1671		(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)							11.5960 (36)
Total fabric heat loss						(33) + (36) =	70.7631 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.9721	42.7244	42.4816	41.3411	41.1277	40.1343	40.1343	39.9504	40.5169	41.1277	41.5593	42.0106 (38)
Heat transfer coeff	113.7352	113.4875	113.2447	112.1042	111.8908	110.8974	110.8974	110.7135	111.2801	111.8908	112.3225	112.7738 (39)
Average = Sum(39)m / 12 =												112.1032 (39)
HLP	1.2414	1.2387	1.2360	1.2236	1.2212	1.2104	1.2104	1.2084	1.2146	1.2212	1.2260	1.2309 (40)
HLP (average)												1.2236 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (45)
Energy content (annual)										Total = Sum(45)m =		1527.3239 (45)
Distribution loss (46)m = 0.15 x (45)m												
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (46)	
Water storage loss:												
Total storage loss												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 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)
Combi loss	50.9589	46.0274	50.4563	46.9138	46.4989	43.0841	44.5202	46.4989	46.9138	50.4563	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	209.3097	184.5220	193.3703	171.5097	166.0517	146.2491	140.1177	156.1984	157.9235	179.8274	190.5337	204.3132 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	209.3097	184.5220	193.3703	171.5097	166.0517	146.2491	140.1177	156.1984	157.9235	179.8274	190.5337	204.3132 (64)
Heat gains from water heating, kWh/month	65.3914	57.5563	60.1330	53.1566	51.3760	45.0734	42.9162	48.0998	48.6392	55.6300	59.2840	63.7300 (65)
Solar input (sum of months) = Sum (63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum (64)m = 2099.9266 (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)
(66)m	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0274	19.5645	15.9109	12.0456	9.0042	7.6018	8.2140	10.6768	14.3304	18.1957	21.2371	22.6396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0267	244.5382	238.2094	224.7360	207.7283	191.7434	181.0646	178.5531	184.8819	198.3553	215.3630	231.3479	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	87.8916	85.6493	80.8239	73.8286	69.0538	62.6019	57.6831	64.6503	67.5544	74.7714	82.3388	85.6586	(72)
Total internal gains	417.6545	415.4608	400.6530	376.3190	351.4951	327.6559	312.6704	319.5890	332.4755	357.0313	384.6477	405.3549	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.4800	10.6334	0.6300	0.7000	0.7700	1.5599 (74)
East	5.1600	19.6403	0.6300	0.7000	0.7700	30.9720 (76)
South	6.9700	46.7521	0.6300	0.7000	0.7700	99.5876 (78)
West	3.9300	19.6403	0.6300	0.7000	0.7700	23.5891 (80)

Solar gains	155.7086	272.8129	388.5986	499.3053	569.8239	568.8268	547.2220	495.1409	427.5517	306.1137	188.0009	132.2216	(83)
Total gains	573.3631	688.2737	789.2516	875.6242	921.3190	896.4826	859.8924	814.7299	760.0272	663.1449	572.6486	537.5765	(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	55.9413	56.0634	56.1836	56.7552	56.8635	57.3728	57.3728	57.4682	57.1756	56.8635	56.6449	56.4183	
alpha	4.7294	4.7376	4.7456	4.7837	4.7909	4.8249	4.8249	4.8312	4.8117	4.7909	4.7763	4.7612	
util living area	0.9976	0.9939	0.9837	0.9525	0.8735	0.7198	0.5509	0.5992	0.8321	0.9698	0.9947	0.9982	(86)
MIT	19.6616	19.8469	20.1263	20.4716	20.7614	20.9347	20.9856	20.9786	20.8628	20.4732	19.9974	19.6282	(87)
Th 2	19.8870	19.8892	19.8913	19.9012	19.9030	19.9117	19.9117	19.9133	19.9084	19.9030	19.8993	19.8954	(88)
util rest of house	0.9967	0.9918	0.9779	0.9346	0.8257	0.6245	0.4230	0.4703	0.7548	0.9548	0.9926	0.9976	(89)
MIT 2	18.1130	18.3844	18.7905	19.2865	19.6702	19.8684	19.9065	19.9047	19.8005	19.2987	18.6120	18.0700	(90)
Living area fraction	18.4095	18.6644	19.0462	19.5134	19.8791	20.0725	20.1131	20.1103	20.0039	19.5236	18.8772	18.3683	(92)
Temperature adjustment	18.4095	18.6644	19.0462	19.5134	19.8791	20.0725	20.1131	20.1103	20.0039	19.5236	18.8772	18.3683	(93)
adjusted MIT	18.4095	18.6644	19.0462	19.5134	19.8791	20.0725	20.1131	20.1103	20.0039	19.5236	18.8772	18.3683	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9950	0.9884	0.9717	0.9266	0.8245	0.6399	0.4476	0.4949	0.7626	0.9478	0.9895	0.9963	(94)
Useful gains	570.5206	680.2730	766.9390	811.3800	759.6588	573.6148	384.8711	403.1894	579.6248	628.5584	566.6474	535.5782	(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	1604.7436	1562.0852	1420.7909	1189.8070	915.1710	606.8886	389.5909	410.7782	656.9833	998.4661	1322.8487	1597.8126	(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	769.4619	592.5778	486.4658	272.4674	115.7011	0.0000	0.0000	0.0000	0.0000	275.2113	544.4650	790.3024	(98)
Space heating												3846.6527	(98)
Space heating per m2												41.9849	(99)
										(98) / (4) =			

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													4118.4719 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	769.4619	592.5778	486.4658	272.4674	115.7011	0.0000	0.0000	0.0000	0.0000	275.2113	544.4650	790.3024	(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)	823.8350	634.4516	520.8413	291.7210	123.8770	0.0000	0.0000	0.0000	0.0000	294.6588	582.9389	846.1482	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating requirement	209.3097	184.5220	193.3703	171.5097	166.0517	146.2491	140.1177	156.1984	157.9235	179.8274	190.5337	204.3132	(64)
Efficiency of water heater (217)m	88.0321	87.7784	87.2776	86.2111	84.1613	80.3000	80.3000	80.3000	80.3000	86.1193	87.5455	88.1231	(217)
Fuel for water heating, kWh/month	237.7651	210.2135	221.5579	198.9415	197.3017	182.1283	174.4928	194.5186	196.6669	208.8119	217.6396	231.8497	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													4118.4719 (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)													389.0105 (232)
Total delivered energy for all uses													7054.3699 (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	4118.4719	0.2160	889.5899 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2471.8875	0.2160	533.9277 (264)
Space and water heating			1423.5176 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.0105	0.5190	201.8964 (268)
Total CO2, kg/m2/year			1664.3391 (272)
Emissions per m2 for space and water heating			15.5372 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2036 (272b)
Emissions per m2 for pumps and fans			0.4249 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.5372 * 1.00) + 2.2036 + 0.4249, rounded to 2 d.p.			18.1700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1353 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3853 (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)	=	0.3275 (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	0.4175	0.4094	0.4012	0.3602	0.3520	0.3111	0.3111	0.3029	0.3275	0.3520	0.3684	0.3848 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5536	0.5620	0.5679	0.5740 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			9.0000	410.1300 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17290.5900 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							188.7207 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.9721	42.7244	42.4816	41.3411	41.1277	40.1343	40.1343	39.9504	40.5169	41.1277	41.5593	42.0106 (38)
Heat transfer coeff	122.3957	122.1479	121.9051	120.7646	120.5512	119.5579	119.5579	119.3739	119.9405	120.5512	120.9829	121.4342 (39)
Average = Sum(39)m / 12 =												120.7636 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3359	1.3332	1.3306	1.3181	1.3158	1.3049	1.3049	1.3029	1.3091	1.3158	1.3205	1.3254 (40)
HLP (average)												1.3181 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.6495	29.4301	30.3692	26.4766	25.4050	21.9226	20.3145	23.3111	23.5896	27.4914	30.0090	32.5878 (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	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0274	19.5645	15.9109	12.0456	9.0042	7.6018	8.2140	10.6768	14.3304	18.1957	21.2371	22.6396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0267	244.5382	238.2094	224.7360	207.7283	191.7434	181.0646	178.5531	184.8819	198.3553	215.3630	231.3479	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	45.2279	43.7948	40.8189	36.7731	34.1465	30.4480	27.3044	31.3322	32.7633	36.9507	41.6791	43.8008	(72)
Total internal gains	371.9908	370.6063	357.6479	336.2635	313.5877	292.5019	279.2917	283.2709	294.6844	316.2106	340.9880	360.4970	(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					0.4800	10.6334	0.4400	0.0000	0.7700		1.7292 (74)	
East					5.1600	19.6403	0.4400	0.0000	0.7700		34.3353 (76)	
South					6.9700	46.7521	0.4400	0.0000	0.7700		110.4020 (78)	
West					3.9300	19.6403	0.4400	0.0000	0.7700		26.1507 (80)	
Solar gains	172.6172	302.4381	430.7971	553.5256	631.7020	630.5966	606.6457	548.9090	473.9802	339.3550	208.4162	146.5798 (83)
Total gains	544.6080	673.0444	788.4451	889.7891	945.2897	923.0985	885.9374	832.1799	768.6646	655.5656	549.4042	507.0768 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.2411	39.3207	39.3990	39.7711	39.8415	40.1725	40.1725	40.2344	40.0444	39.8415	39.6993	39.5518	
alpha	3.6161	3.6214	3.6266	3.6514	3.6561	3.6782	3.6782	3.6823	3.6696	3.6561	3.6466	3.6368	
util living area	0.9938	0.9864	0.9696	0.9290	0.8466	0.7072	0.5549	0.6032	0.8139	0.9531	0.9885	0.9952	(86)
MIT	19.1664	19.4095	19.7746	20.2226	20.6068	20.8620	20.9577	20.9421	20.7521	20.2293	19.6061	19.1222	(87)
Th 2	19.8128	19.8149	19.8170	19.8267	19.8285	19.8370	19.8370	19.8385	19.8337	19.8285	19.8248	19.8210	(88)
util rest of house	0.9922	0.9827	0.9612	0.9080	0.7991	0.6158	0.4249	0.4740	0.7401	0.9351	0.9849	0.9939	(89)
MIT 2	18.1554	18.3982	18.7596	19.2000	19.5534	19.7661	19.8240	19.8189	19.6879	19.2163	18.6025	18.1175	(90)
Living area fraction	18.3489	18.5918	18.9539	19.3958	19.7550	19.9759	20.0410	20.0339	19.8916	19.4103	18.7946	18.3098	(92)
Temperature adjustment	18.3489	18.5918	18.9539	19.3958	19.7550	19.9759	20.0410	20.0339	19.8916	19.4103	18.7946	18.3098	(93)
adjusted MIT	18.3489	18.5918	18.9539	19.3958	19.7550	19.9759	20.0410	20.0339	19.8916	19.4103	18.7946	18.3098	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	538.7568	657.9294	751.4516	799.5368	752.1237	579.5666	397.9126	413.9975	572.2025	607.4845	538.5970	502.8000	(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	1719.5269	1672.4217	1518.1924	1267.5210	971.0451	642.7306	411.4012	433.7939	694.6523	1062.0864	1414.8507	1713.4170	(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	878.4930	681.7388	570.4551	336.9487	162.8775	0.0000	0.0000	0.0000	0.0000	338.2239	630.9026	900.6991	(98)
Space heating												4500.3386	(98)
Space heating per m ²												49.1196	(99)

8c. Space cooling requirement

Calculated for June, July and August. See Table 10b	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Ext. temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	
Heat loss rate W													

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Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	1123.8438	884.7281	907.2417	0.0000	0.0000	0.0000	0.0000 (100)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.8047	0.8715	0.8468	0.0000	0.0000	0.0000	0.0000 (101)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	904.3750	771.0233	768.2959	0.0000	0.0000	0.0000	0.0000 (102)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1179.1733	1133.6271	1072.5792	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	197.8548	269.7772	226.3868	0.0000	0.0000	0.0000	0.0000 (104)
Cooled fraction									FC = cooled area / (4) =			694.0187 (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	49.4637	67.4443	56.5967	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling per m2												173.5047 (107)
Energy for space heating												1.8937 (108)
Energy for space cooling												49.1196 (99)
Total												1.8937 (108)
Dwelling Fabric Energy Efficiency (DFEE)												51.0134 (109)
												51.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Target Fabric Energy Efficiency 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1353 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3853 (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) =	0.3275 (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	0.4175	0.4094	0.4012	0.3602	0.3520	0.3111	0.3111	0.3029	0.3275	0.3520	0.3684	0.3848 (22b)
Effective ac	0.5872	0.5838	0.5805	0.5649	0.5620	0.5484	0.5484	0.5459	0.5536	0.5620	0.5679	0.5740 (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)			16.5400	1.3258	21.9280		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.1800	20.5920		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)
Bay Roof/GRP	0.5300		0.5300	0.1300	0.0689		(30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	59.1671		(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)							11.5960 (36)
Total fabric heat loss						(33) + (36) =	70.7631 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	42.9721	42.7244	42.4816	41.3411	41.1277	40.1343	40.1343	39.9504	40.5169	41.1277	41.5593	42.0106 (38)
Heat transfer coeff	113.7352	113.4875	113.2447	112.1042	111.8908	110.8974	110.8974	110.7135	111.2801	111.8908	112.3225	112.7738 (39)
Average = Sum(39)m / 12 =												112.1032 (39)
HLP	1.2414	1.2387	1.2360	1.2236	1.2212	1.2104	1.2104	1.2084	1.2146	1.2212	1.2260	1.2309 (40)
HLP (average)												1.2236 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (45)
Energy content (annual)										Total = Sum(45)m =		1527.3239 (45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss												

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.6495	29.4301	30.3692	26.4766	25.4050	21.9226	20.3145	23.3111	23.5896	27.4914	30.0090	32.5878 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	132.3626	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	22.0274	19.5645	15.9109	12.0456	9.0042	7.6018	8.2140	10.6768	14.3304	18.1957	21.2371	22.6396	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	242.0267	244.5382	238.2094	224.7360	207.7283	191.7434	181.0646	178.5531	184.8819	198.3553	215.3630	231.3479	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	36.2363	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	45.2279	43.7948	40.8189	36.7731	34.1465	30.4480	27.3044	31.3322	32.7633	36.9507	41.6791	43.8008	(72)
Total internal gains	371.9908	370.6063	357.6479	336.2635	313.5877	292.5019	279.2917	283.2709	294.6844	316.2106	340.9880	360.4970	(73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	0.4800	10.6334	0.6300	0.7000	0.7700	1.5599 (74)
East	5.1600	19.6403	0.6300	0.7000	0.7700	30.9720 (76)
South	6.9700	46.7521	0.6300	0.7000	0.7700	99.5876 (78)
West	3.9300	19.6403	0.6300	0.7000	0.7700	23.5891 (80)

Solar gains	155.7086	272.8129	388.5986	499.3053	569.8239	568.8268	547.2220	495.1409	427.5517	306.1137	188.0009	132.2216	(83)
Total gains	527.6993	643.4192	746.2465	835.5687	883.4116	861.3287	826.5137	778.4118	722.2361	622.3242	528.9889	492.7187	(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	55.9413	56.0634	56.1836	56.7552	56.8635	57.3728	57.3728	57.4682	57.1756	56.8635	56.6449	56.4183	
alpha	4.7294	4.7376	4.7456	4.7837	4.7909	4.8249	4.8249	4.8312	4.8117	4.7909	4.7763	4.7612	
util living area	0.9983	0.9954	0.9869	0.9597	0.8875	0.7397	0.5704	0.6224	0.8523	0.9762	0.9962	0.9988	(86)
MIT	19.6161	19.8029	20.0861	20.4391	20.7404	20.9264	20.9833	20.9749	20.8457	20.4372	19.9543	19.5832	(87)
Th 2	19.8870	19.8892	19.8913	19.9012	19.9030	19.9117	19.9117	19.9133	19.9084	19.9030	19.8993	19.8954	(88)
util rest of house	0.9977	0.9938	0.9821	0.9440	0.8427	0.6451	0.4394	0.4908	0.7790	0.9640	0.9947	0.9984	(89)
MIT 2	18.6304	18.8182	19.1005	19.4516	19.7276	19.8778	19.9075	19.9063	19.8235	19.4568	18.9777	18.6042	(90)
Living area fraction									fLA = Living area / (4) =			0.1914	(91)
MIT	18.8191	19.0067	19.2892	19.6406	19.9215	20.0785	20.1135	20.1108	20.0192	19.6445	19.1647	18.7917	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8191	19.0067	19.2892	19.6406	19.9215	20.0785	20.1135	20.1108	20.0192	19.6445	19.1647	18.7917	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	526.0677	638.2658	730.3426	784.9060	745.2665	569.3223	384.0946	401.7705	568.9202	597.5101	525.3654	491.6096	(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	1651.3352	1600.9355	1448.3043	1204.0708	919.9099	607.5559	389.6342	410.8393	658.6897	1011.9907	1355.1328	1645.5578	(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	837.1990	646.9140	534.1635	301.7987	129.9347	0.0000	0.0000	0.0000	0.0000	308.3736	597.4325	858.5374	(98)
Space heating												4214.3534	(98)
Space heating per m ²										(98) / (4) =		45.9982	(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	1042.4360	820.6411	841.4225	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8522	0.9163	0.8945	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	888.3795	751.9136	752.6478	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1106.9748	1064.1708	1009.7333	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	157.3887	232.3194	191.2716	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												580.9796 (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	39.3472	58.0798	47.8179	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												145.2449 (107)
Space cooling per m2												1.5853 (108)
Energy for space heating												45.9982 (99)
Energy for space cooling												1.5853 (108)
Total												47.5835 (109)
Target Fabric Energy Efficiency (TFEE)												54.7 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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) = 0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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)	=	0.3658 (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	0.3841	0.3658	0.3658	0.3384	0.3384	0.3018	0.3109	0.2926	0.3018	0.3201	0.3201	0.3475 (22b)
Effective ac	0.5738	0.5669	0.5669	0.5572	0.5572	0.5455	0.5483	0.5428	0.5455	0.5512	0.5512	0.5604 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9912	41.4893	41.4893	40.7823	40.7823	39.9254	40.1304	39.7265	39.9254	40.3416	40.3416	41.0119 (38)
Heat transfer coeff	121.4147	120.9128	120.9128	120.2059	120.2059	119.3489	119.5540	119.1500	119.3489	119.7652	119.7652	120.4354 (39)
Average = Sum(39)m / 12 =												120.0850 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3252	1.3197	1.3197	1.3120	1.3120	1.3027	1.3049	1.3005	1.3027	1.3072	1.3072	1.3145 (40)
HLP (average)												1.3107 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 =			1527.3239 (45)
Distribution loss (46)m = 0.15 x (45)m													
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031	(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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517	14.1246 (61)	
Total heat required for water heating calculated for each month													
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789	(62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)	
							Solar input (sum of months) = Sum(63)m =						0.0000 (63)
Output from w/h													
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789	(64)	
							Total per year (kWh/year) = Sum(64)m =						1692.8195 (64)
RHI water heating demand													1693 (64)
Heat gains from water heating, kWh/month													
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215	(65)	

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

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0685	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900 (71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815 (72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516 (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					0.4800	11.9814	0.4400	0.0000	0.7700		1.9485 (74)	
East					5.1600	22.3313	0.4400	0.0000	0.7700		39.0398 (76)	
South					6.9700	50.9848	0.4400	0.0000	0.7700		120.3974 (78)	
West					3.9300	22.3313	0.4400	0.0000	0.7700		29.7338 (80)	
Solar gains	191.1194	301.3546	424.5455	563.8654	629.0095	673.0946	640.0555	590.5346	506.8255	361.1373	236.4005	160.7318 (83)
Total gains	792.4161	897.9962	997.9412	1101.1424	1129.1777	1140.0988	1087.7250	1046.9285	984.0459	874.6979	790.3621	745.3834 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	40.4965	40.6646	40.6646	40.9037	40.9037	41.1974	41.1267	41.2662	41.1974	41.0542	41.0542	40.8258
alpha	3.6998	3.7110	3.7110	3.7269	3.7269	3.7465	3.7418	3.7511	3.7465	3.7369	3.7369	3.7217
util living area	0.9778	0.9643	0.9319	0.8568	0.7211	0.5003	0.3367	0.3589	0.6346	0.8755	0.9593	0.9816 (86)
MIT	19.6101	19.8005	20.1398	20.5287	20.8222	20.9681	20.9947	20.9933	20.9182	20.5653	20.0356	19.5736 (87)
Th 2	19.8211	19.8254	19.8254	19.8314	19.8314	19.8388	19.8370	19.8405	19.8388	19.8352	19.8352	19.8295 (88)
util rest of house	0.9719	0.9551	0.9139	0.8191	0.6495	0.3938	0.2124	0.2315	0.5321	0.8335	0.9468	0.9766 (89)
MIT 2	18.0293	18.3045	18.7842	19.3158	19.6763	19.8226	19.8360	19.8391	19.7856	19.3803	18.6519	17.9827 (90)
Living area fraction												
MIT	18.3319	18.5909	19.0437	19.5480	19.8957	20.0419	20.0578	20.0600	20.0024	19.6072	18.9168	18.2872 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1819	18.4409	18.8937	19.3980	19.7457	19.8919	19.9078	19.9100	19.8524	19.4572	18.7668	18.1372 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9602	0.9402	0.8956	0.8025	0.6436	0.3989	0.2201	0.2393	0.5334	0.8167	0.9311	0.9662 (94)
Useful gains	760.9060	844.2925	893.7290	883.6327	726.7469	454.8365	239.3894	250.5046	524.8977	714.3774	735.8921	720.1691 (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												
	1588.3405	1552.6275	1389.7407	1141.7132	810.8675	464.4950	240.0454	251.4118	555.2624	941.0130	1289.4901	1570.1458 (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												
	615.6113	476.0011	369.0327	185.8180	62.5857	0.0000	0.0000	0.0000	0.0000	168.6168	398.5905	632.3826 (98)
Space heating												2908.6388 (98)
RHI space heating demand												2909 (98)

FULL SAP CALCULATION PRINTOUT

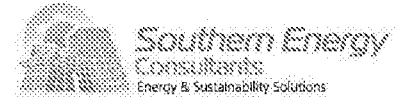
Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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) =	0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =		0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298 (22b)
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.5528	44.2437	43.9407	42.5176	42.2513	41.0119	41.0119	40.7823	41.4893	42.2513	42.7900	43.3531 (38)
Heat transfer coeff	123.9763	123.6672	123.3642	121.9411	121.6749	120.4354	120.4354	120.2059	120.9128	121.6749	122.2135	122.7766 (39)
Average = Sum(39)m / 12 =												121.9399 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3532	1.3498	1.3465	1.3309	1.3280	1.3145	1.3145	1.3120	1.3197	1.3280	1.3339	1.3401 (40)
HLP (average)												1.3309 (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		2.6473 (42)
Average daily hot water use (litres/day)		97.0722 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (45)

Regs Region: England

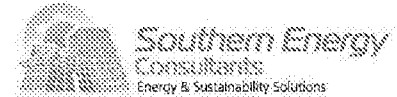
Elmhurst Energy Systems

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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (65)
Total per year (kWh/year) = Sum(64)m =	1692.8195 (64)										

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0685	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516	(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				0.4800	10.6334		0.4400		0.0000		0.7700		1.7292 (74)
East				5.1600	19.6403		0.4400		0.0000		0.7700		34.3353 (76)
South				6.9700	46.7521		0.4400		0.0000		0.7700		110.4020 (78)
West				3.9300	19.6403		0.4400		0.0000		0.7700		26.1507 (80)
Solar gains	172.6172	302.4381	430.7971	553.5256	631.7020	630.5966	606.6457	548.9090	473.9802	339.3550	208.4162		146.5798 (83)
Total gains	773.9139	899.0797	1004.1928	1090.8026	1131.8702	1097.6007	1054.3152	1005.3029	951.2006	852.9157	762.3778		731.2314 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	39.6597	39.7589	39.8565	40.3216	40.4099	40.8258	40.8258	40.9037	40.6646	40.4099	40.2318	40.0473
alpha	3.6440	3.6506	3.6571	3.6881	3.6940	3.7217	3.7217	3.7269	3.7110	3.6940	3.6821	3.6698
util living area	0.9825	0.9691	0.9430	0.8870	0.7869	0.6331	0.4825	0.5217	0.7333	0.9100	0.9705	0.9855 (86)
MIT	19.4337	19.6603	19.9921	20.3899	20.7104	20.9085	20.9745	20.9656	20.8353	20.4119	19.8489	19.3911 (87)
Th 2	19.7994	19.8020	19.8046	19.8167	19.8189	19.8295	19.8295	19.8314	19.8254	19.8189	19.8144	19.8096 (88)
util rest of house	0.9780	0.9613	0.9284	0.8573	0.7305	0.5404	0.3632	0.4014	0.6493	0.8796	0.9616	0.9818 (89)
MIT 2	17.7599	18.0873	18.5612	19.1198	19.5354	19.7648	19.8188	19.8157	19.6937	19.1650	18.3713	17.7049 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	18.0804	18.3884	18.8352	19.3629	19.7603	19.9838	20.0400	20.0358	19.9123	19.4037	18.6541	18.0277 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9304	18.2384	18.6852	19.2129	19.6103	19.8338	19.8900	19.8858	19.7623	19.2537	18.5041	17.8777 (93)

8. Space heating requirement

Utilisation	0.9677	0.9472	0.9104	0.8388	0.7191	0.5408	0.3696	0.4073	0.6442	0.8611	0.9478	0.9727 (94)
Useful gains	748.8788	851.6301	914.2054	914.9467	813.9395	593.5961	389.6940	409.4982	612.7402	734.4426	722.5607	711.2912 (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	1689.8422	1649.5247	1503.2125	1257.5710	962.4893	630.3320	396.2369	419.0167	684.6424	1052.9355	1393.7393	1679.3037 (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	700.0768	536.1852	438.2212	246.6895	110.5211	0.0000	0.0000	0.0000	0.0000	236.9588	483.2486	720.2013 (98)
Space heating												3472.1024 (98)
Space heating per m2												(98) / (4) = 37.8968 (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												3836.5772 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	700.0768	536.1852	438.2212	246.6895	110.5211	0.0000	0.0000	0.0000	0.0000	236.9588	483.2486	720.2013 (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)	773.5655	592.4698	484.2223	272.5851	122.1227	0.0000	0.0000	0.0000	0.0000	261.8329	533.9764	795.8025 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating												
Water heating requirement	172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Efficiency of water heater (217)m	89.8490	89.7760	89.6333	89.3244	88.7204	87.3000	87.3000	87.3000	87.3000	89.2662	89.7020	87.3000 (216)
Fuel for water heating, kWh/month	191.9749	168.4775	175.1694	154.7094	150.5529	133.6702	125.4920	141.6911	142.6987	160.6824	172.6499	186.3394 (219)
Water heating fuel used												1904.1077 (219)
Annual totals kWh/year												
Space heating fuel - main system												3836.5772 (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)												389.0105 (232)
Total delivered energy for all uses												6204.6954 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3836.5772	3.4800	133.5129 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1904.1077	3.4800	66.2629 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	389.0105	13.1900	51.3105 (250)
Additional standing charges			120.0000 (251)
Total energy cost			380.9788 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1712 (257)
SAP value		83.6616
SAP rating (Section 12)		84 (258)
SAP band		B

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3836.5772	0.2160	828.7007 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1904.1077	0.2160	411.2873 (264)
Space and water heating			1239.9879 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.0105	0.5190	201.8964 (268)
Total kg/year			1480.8094 (272)
CO2 emissions per m2			16.1600 (273)
EI value			85.4759
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	$3.48 / 0.8878 = 3.920$, stars = 4
Water heating environmental impact	$0.216 / 0.8878 = 0.2433$, 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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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) =	0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =		0.3658 (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	0.3841	0.3658	0.3658	0.3384	0.3384	0.3018	0.3109	0.2926	0.3018	0.3201	0.3201	0.3475 (22b)
Effective ac	0.5738	0.5669	0.5669	0.5572	0.5572	0.5455	0.5483	0.5428	0.5455	0.5512	0.5512	0.5604 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9912	41.4893	41.4893	40.7823	40.7823	39.9254	40.1304	39.7265	39.9254	40.3416	40.3416	41.0119 (38)
Heat transfer coeff	121.4147	120.9128	120.9128	120.2059	120.2059	119.3489	119.5540	119.1500	119.3489	119.7652	119.7652	120.4354 (39)
Average = Sum(39)m / 12 =												120.0850 (39)
HLP	1.3252	1.3197	1.3197	1.3120	1.3120	1.3027	1.3049	1.3005	1.3027	1.3072	1.3072	1.3145 (40)
HLP (average)												1.3107 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0685	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516	(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					0.4800	11.9814	0.4400	0.0000	0.7700		1.9485 (74)	
East					5.1600	22.3313	0.4400	0.0000	0.7700		39.0398 (76)	
South					6.9700	50.9848	0.4400	0.0000	0.7700		120.3974 (78)	
West					3.9300	22.3313	0.4400	0.0000	0.7700		29.7338 (80)	
Solar gains	191.1194	301.3546	424.5455	563.8654	629.0095	673.0946	640.0555	590.5346	506.8255	361.1373	236.4005	160.7318 (83)
Total gains	792.4161	897.9962	997.9412	1101.1424	1129.1777	1140.0988	1087.7250	1046.9285	984.0459	874.6979	790.3621	745.3834 (84)

7. Mean internal temperature (heating season)

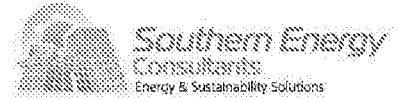
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.4965	40.6646	40.6646	40.9037	40.9037	41.1974	41.1267	41.2662	41.1974	41.0542	41.0542	40.8258
alpha	3.6998	3.7110	3.7110	3.7269	3.7269	3.7465	3.7418	3.7511	3.7465	3.7369	3.7369	3.7217
util living area	0.9778	0.9643	0.9319	0.8568	0.7211	0.5003	0.3367	0.3589	0.6346	0.8755	0.9593	0.9816 (86)
MIT	19.6101	19.8005	20.1398	20.5287	20.8222	20.9681	20.9947	20.9933	20.9182	20.5653	20.0356	19.5736 (87)
Th 2	19.8211	19.8254	19.8254	19.8314	19.8314	19.8388	19.8370	19.8405	19.8388	19.8352	19.8352	19.8295 (88)
util rest of house	0.9719	0.9551	0.9139	0.8191	0.6495	0.3938	0.2124	0.2315	0.5321	0.8335	0.9468	0.9766 (89)
MIT 2	18.0293	18.3045	18.7842	19.3158	19.6763	19.8226	19.8360	19.8391	19.7856	19.3803	18.6519	17.9827 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	18.3319	18.5909	19.0437	19.5480	19.8957	20.0419	20.0578	20.0600	20.0024	19.6072	18.9168	18.2872 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1819	18.4409	18.8937	19.3980	19.7457	19.8919	19.9078	19.9100	19.8524	19.4572	18.7668	18.1372 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9602	0.9402	0.8956	0.8025	0.6436	0.3989	0.2201	0.2393	0.5334	0.8167	0.9311	0.9662 (94)
Useful gains	760.9060	844.2925	893.7290	883.6327	726.7469	454.8365	239.3894	250.5046	524.8977	714.3774	735.8921	720.1691 (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	1588.3405	1552.6275	1389.7407	1141.7132	810.8675	464.4950	240.0454	251.4118	555.2624	941.0130	1289.4901	1570.1458 (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	615.6113	476.0011	369.0327	185.8180	62.5857	0.0000	0.0000	0.0000	0.0000	168.6168	398.5905	632.3826 (98)
Space heating												2908.6388 (98)
Space heating per m2												(98) / (4) = 31.7468 (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													3213.9655 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	615.6113	476.0011	369.0327	185.8180	62.5857	0.0000	0.0000	0.0000	0.0000	168.6168	398.5905	632.3826	(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)	680.2334	525.9681	407.7710	205.3237	69.1555	0.0000	0.0000	0.0000	0.0000	186.3169	440.4315	698.7653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789	(64)
Efficiency of water heater	89.7797	89.7071	89.5206	89.1069	88.2961	87.3000	87.3000	87.3000	87.3000	89.0005	89.5812	87.3000	(216)
(217)m	89.7797	89.7071	89.5206	89.1069	88.2961	87.3000	87.3000	87.3000	87.3000	89.0005	89.5812	89.8107	(217)
Fuel for water heating, kWh/month	192.1229	168.6068	175.3901	155.0869	151.2763	133.6702	125.4920	141.6911	142.6987	161.1622	172.8827	186.4799	(219)
Water heating fuel used													1906.5598 (219)
Annual totals kWh/year													
Space heating fuel - main system													3213.9655 (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)													389.0105 (232)
Total delivered energy for all uses													5584.5359 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3213.9655	3.8700	124.3805 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1906.5598	3.8700	73.7839 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	389.0105	18.9000	73.5230 (250)
Additional standing charges			93.0000 (251)
Total energy cost			378.8623 (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	3213.9655	0.2160	694.2166 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1906.5598	0.2160	411.8169 (264)
Space and water heating			1106.0335 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	389.0105	0.5190	201.8964 (268)
Total kg/year			1346.8549 (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	3213.9655	1.2200	3921.0380 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1906.5598	1.2200	2326.0030 (264)
Space and water heating			6247.0409 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	389.0105	3.0700	1194.2622 (268)
Primary energy kWh/year			7671.5531 (272)
Primary energy kWh/m2/year			83.7323 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 29	-187 kg (13.9%)
U Solar photovoltaic panels	+ 9.8	-£ 345	-947 kg (81.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.04 kg/m²	B 85 B 87
Solar photovoltaic panels	£345	10.33 kg/m²	A 95 A 96
Total Savings	£373	12.37 kg/m²	

Potential energy efficiency rating: A 95
 Potential environmental impact rating: A 96

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

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

	Current	Potential	Saving
Electricity	£88	£97	-£9
Mains gas	£291	£253	£38
Space heating	£232	£232	£0
Water heating	£74	£45	£29
Lighting	£74	£74	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£379	£5	£374
Total cost of uses	£380	£6	£374
Delivered energy	61 kWh/m²	31 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	2 kg/m²	12 kg/m²
Primary energy	84 kWh/m²	11 kWh/m²	73 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 221.7732 (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) = 0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) =		0.3658 (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	0.4664	0.4573	0.4481	0.4024	0.3932	0.3475	0.3475	0.3384	0.3658	0.3932	0.4115	0.4298 (22b)
Effective ac	0.6088	0.6045	0.6004	0.5810	0.5773	0.5604	0.5604	0.5572	0.5669	0.5773	0.5847	0.5924 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss						(33) + (36) =	79.4235 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.5528	44.2437	43.9407	42.5176	42.2513	41.0119	41.0119	40.7823	41.4893	42.2513	42.7900	43.3531 (38)
Heat transfer coeff	123.9763	123.6672	123.3642	121.9411	121.6749	120.4354	120.4354	120.2059	120.9128	121.6749	122.2135	122.7766 (39)
Average = Sum(39)m / 12 =												121.9399 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3532	1.3498	1.3465	1.3309	1.3280	1.3145	1.3145	1.3120	1.3197	1.3280	1.3339	1.3401 (40)
HLP (average)												1.3309 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (45)

Regs Region: England

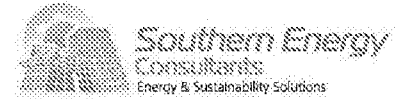
Elmhurst Energy Systems

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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											3.0000 (H1)
Collector heat loss coefficient											0.7000 (H2)
Collector 2nd order heat loss coefficient											1.8000 (H3)
Collector effective heat loss coefficient											0.0050 (H3a)
Collector performance ratio											1.8063 (H3b)
Annual solar radiation per m2											2.5804 (H4)
Overshading factor											1079.5246 (H5)
Solar energy available											0.8000 (H6)
Adjustment factor for showers											1813.6014 (H7)
Solar-to-load ratio											1.0000 (H7a)
Utilisation factor											1.1874 (H8)
Collector performance factor											0.5692 (H9)
Dedicated solar storage volume											0.8793 (H10)
Effective solar volume											75.0000 (H11)
Daily hot water demand											75.0000 (H13)
Volume ratio Veff/V											97.0722 (H14)
Solar storage volume factor											0.7726 (H15)
Solar input											0.9484 (H16)
Solar input	-24.9641	-41.6579	-70.9482	-95.0845	-117.4689	-115.4907	-113.9644	-99.5713	-77.9843	-53.2541	-29.6110 (H17)
Output from w/h											-860.8902 (H17)
147.5233	109.5944	86.0621	43.1087	16.1022	1.2034	0.0000	24.1250	46.5916	90.1810	125.2594	146.5882 (64)
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	836.3393 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0695	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516	(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	0.4800	10.6334	0.4400	0.0000	0.7700	1.7292 (74)
East	5.1600	19.6403	0.4400	0.0000	0.7700	34.3353 (76)
South	6.9700	46.7521	0.4400	0.0000	0.7700	110.4020 (78)
West	3.9300	19.6403	0.4400	0.0000	0.7700	26.1507 (80)

Solar gains	172.6172	302.4381	430.7971	553.5256	631.7020	630.5966	606.6457	548.9090	473.9802	339.3550	208.4162	146.5798 (83)
Total gains	773.9139	899.0797	1004.1928	1090.8026	1131.8702	1097.6007	1054.3152	1005.3029	951.2006	852.9157	762.3778	731.2314 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.6597	39.7589	39.8565	40.3216	40.4099	40.8258	40.8258	40.9037	40.6646	40.4099	40.2318	40.0473
alpha	3.6440	3.6506	3.6571	3.6881	3.6940	3.7217	3.7217	3.7269	3.7110	3.6940	3.6821	3.6698
util living area	0.9825	0.9691	0.9430	0.8870	0.7869	0.6331	0.4825	0.5217	0.7333	0.9100	0.9705	0.9855 (86)
MIT	19.4337	19.6603	19.9921	20.3899	20.7104	20.9085	20.9745	20.9656	20.8353	20.4119	19.8489	19.3911 (87)
Th 2	19.7994	19.8020	19.8046	19.8167	19.8189	19.8295	19.8295	19.8314	19.8254	19.8189	19.8144	19.8096 (88)
util rest of house	0.9780	0.9613	0.9284	0.8573	0.7305	0.5404	0.3632	0.4014	0.6493	0.8796	0.9616	0.9818 (89)
MIT 2	17.7599	18.0873	18.5612	19.1198	19.5354	19.7648	19.8188	19.8157	19.6937	19.1650	18.3713	17.7049 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	18.0804	18.3884	18.8352	19.3629	19.7603	19.9838	20.0400	20.0358	19.9123	19.4037	18.6541	18.0277 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9304	18.2384	18.6852	19.2129	19.6103	19.8338	19.8900	19.8858	19.7623	19.2537	18.5041	17.8777 (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	0.9677	0.9472	0.9104	0.8388	0.7191	0.5408	0.3696	0.4073	0.6442	0.8611	0.9478	0.9727	(94)
Useful gains	748.8788	851.6301	914.2054	914.9467	813.9395	593.5961	389.6940	409.4982	612.7402	734.4426	722.5607	711.2912	(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	1689.8422	1649.5247	1503.2125	1257.5710	962.4893	630.3320	396.2369	419.0167	684.6424	1052.9355	1393.7393	1679.3037	(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	700.0768	536.1852	438.2212	246.6895	110.5211	0.0000	0.0000	0.0000	0.0000	236.9588	483.2486	720.2013	(98)
Space heating												3472.1024	(98)
Space heating per m2											(98) / (4) =	37.8968	(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													3836.5772 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	700.0768	536.1852	438.2212	246.6895	110.5211	0.0000	0.0000	0.0000	0.0000	236.9588	483.2486	720.2013	(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)	773.5655	592.4698	484.2223	272.5851	122.1227	0.0000	0.0000	0.0000	0.0000	261.8329	533.9764	795.8025	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.5233	109.5944	86.0621	43.1087	16.1022	1.2034	0.0000	24.1250	46.5916	90.1810	125.2594	146.5882	(64)
Efficiency of water heater	89.9263	89.9405	89.9587	90.0092	90.0801	87.3000	87.3000	87.3000	87.3000	89.5947	89.8223	87.3000	(216)
(217)m	89.9263	89.9405	89.9587	90.0092	90.0801	87.3000	87.3000	87.3000	87.3000	89.5947	89.8223	87.3000	(217)
Fuel for water heating, kWh/month	164.0492	121.8521	95.6684	47.8936	17.8754	1.3784	0.0000	27.6346	53.3696	100.6544	139.4525	162.9800	(219)
Water heating fuel used													
Annual totals kWh/year													932.8082 (219)
Space heating fuel - main system													3836.5772 (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)													389.0105 (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													3556.1566 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3836.5772	3.4800	133.5129 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	932.8082	3.4800	32.4617 (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	389.0105	13.1900	51.3105 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			125.9497 (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] =	0.3872 (257)
SAP value			94.5986
SAP rating (Section 12)			95 (258)
SAP band			A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3836.5772	0.2160	828.7007 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	932.8082	0.2160	201.4866 (264)
Space and water heating			1030.1873 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	389.0105	0.5190	201.8964 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			400.5215 (272)
CO2 emissions per m2			4.3700 (273)
EI value			96.0716
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	46.0500 (1c)	x 2.5300 (2c)	= 116.5065 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.6200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	221.7732 (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) = 0.1804 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4304 (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) = 0.3658 (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	0.3841	0.3658	0.3658	0.3384	0.3384	0.3018	0.3109	0.2926	0.3018	0.3201	0.3201	0.3475 (22b)
Effective ac	0.5738	0.5669	0.5669	0.5572	0.5572	0.5455	0.5483	0.5428	0.5455	0.5512	0.5512	0.5604 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Brick/Render Cavity	135.2400	20.8400	114.4000	0.2500	28.6000	60.0000	6864.0000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Bay Roof/GRP	0.5300		0.5300	0.3000	0.1590	9.0000	4.7700 (30)
Total net area of external elements Aum(A, m ²)			226.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	69.7749		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 17700.7200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							193.1971 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.6487 (36)
Total fabric heat loss							(33) + (36) = 79.4235 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.9912	41.4893	41.4893	40.7823	40.7823	39.9254	40.1304	39.7265	39.9254	40.3416	40.3416	41.0119 (38)
Heat transfer coeff	121.4147	120.9128	120.9128	120.2059	120.2059	119.3489	119.5540	119.1500	119.3489	119.7652	119.7652	120.4354 (39)
Average = Sum(39)m / 12 =												120.0850 (39)
HLP	1.3252	1.3197	1.3197	1.3120	1.3120	1.3027	1.3049	1.3005	1.3027	1.3072	1.3072	1.3145 (40)
HLP (average)												1.3107 (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												2.6473 (42)
Average daily hot water use (litres/day)												97.0722 (43)
Daily hot water use	106.7794	102.8965	99.0137	95.1308	91.2479	87.3650	87.3650	91.2479	95.1308	99.0137	102.8965	106.7794 (44)
Energy conte	158.3508	138.4946	142.9141	124.5959	119.5528	103.1650	95.5975	109.6995	111.0097	129.3711	141.2187	153.3543 (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 = 1527.3239 (45)										
Distribution loss (46)m = 0.15 x (45)m											
23.7526	20.7742	21.4371	18.6894	17.9329	15.4747	14.3396	16.4549	16.6515	19.4057	21.1828	23.0031 (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	14.1366	12.7577	14.0962	13.5973	14.0184	13.5291	13.9570	13.9968	13.5663	14.0640	13.6517 (61)
Total heat required for water heating calculated for each month											
172.4874	151.2523	157.0102	138.1932	133.5711	116.6941	109.5545	123.6963	124.5759	143.4351	154.8704	167.4789 (62)
Aperture area of solar collector											
Zero-loss collector efficiency											
Collector heat loss coefficient											
Collector 2nd order heat loss coefficient											
Collector effective heat loss coefficient											
Collector performance ratio											
Annual solar radiation per m2											
Overshading factor											
Solar energy available											
Adjustment factor for showers											
Solar-to-load ratio											
Utilisation factor											
Collector performance factor											
Dedicated solar storage volume											
Effective solar volume											
Daily hot water demand											
Volume ratio Veff/V											
Solar storage volume factor											
Solar input											
Solar input	-27.0155	-40.6042	-68.3826	-94.5257	-113.8407	-119.8124	-116.9355	-104.4241	-81.5034	-55.4452	-32.8380 (63)
Solar input (sum of months) = Sum(63)m =											
Output from w/h											
145.4719	110.6481	88.6276	43.6675	19.7304	0.0000	0.0000	19.2722	43.0725	87.9898	122.0324	145.0964 (64)
Total per year (kWh/year) = Sum(64)m =											
Heat gains from water heating, kWh/month											
56.1858	49.2389	51.0430	44.8275	43.2559	37.6846	35.2754	39.9743	40.3023	46.5319	50.3681	54.5215 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	158.8351	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	55.0695	48.9113	39.7774	30.1140	22.5106	19.0044	20.5349	26.6920	35.8260	45.4893	53.0928	56.5990	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	361.2339	364.9824	355.5364	335.4268	310.0422	286.1842	270.2456	266.4971	275.9432	296.0527	321.4373	345.2953	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	53.5308	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	-105.8900	(71)
Water heating gains (Table 5)	75.5185	73.2721	68.6061	62.2604	58.1396	52.3398	47.4132	53.7289	55.9754	62.5429	69.9557	73.2815	(72)
Total internal gains	601.2967	596.6416	573.3956	537.2770	500.1682	467.0041	447.6695	456.3939	477.2204	513.5607	553.9616	584.6516	(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	0.4800	11.9814	0.4400	0.0000	0.7700	1.9485 (74)
East	5.1600	22.3313	0.4400	0.0000	0.7700	39.0398 (76)
South	6.9700	50.9848	0.4400	0.0000	0.7700	120.3974 (78)
West	3.9300	22.3313	0.4400	0.0000	0.7700	29.7338 (80)

Solar gains	191.1194	301.3546	424.5455	563.8654	629.0095	673.0946	640.0555	590.5346	506.8255	361.1373	236.4005	160.7318 (83)
Total gains	792.4161	897.9962	997.9412	1101.1424	1129.1777	1140.0988	1087.7250	1046.9285	984.0459	874.6979	790.3621	745.3834 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.4965	40.6646	40.6646	40.9037	40.9037	41.1974	41.1267	41.2662	41.1974	41.0542	41.0542	40.8258
alpha	3.6998	3.7110	3.7110	3.7269	3.7269	3.7465	3.7418	3.7511	3.7465	3.7369	3.7369	3.7217
util living area	0.9778	0.9643	0.9319	0.8568	0.7211	0.5003	0.3367	0.3589	0.6346	0.8755	0.9593	0.9816 (86)
MIT	19.6101	19.8005	20.1398	20.5287	20.8222	20.9681	20.9947	20.9933	20.9182	20.5653	20.0356	19.5736 (87)
Th 2	19.8211	19.8254	19.8254	19.8314	19.8314	19.8388	19.8370	19.8405	19.8388	19.8352	19.8352	19.8295 (88)
util rest of house	0.9719	0.9551	0.9139	0.8191	0.6495	0.3938	0.2124	0.2315	0.5321	0.8335	0.9468	0.9766 (89)
MIT 2	18.0293	18.3045	18.7842	19.3158	19.6763	19.8226	19.8360	19.8391	19.7856	19.3803	18.6519	17.9827 (90)
Living area fraction	fLA = Living area / (4) =											0.1914 (91)
MIT	18.3319	18.5909	19.0437	19.5480	19.8957	20.0419	20.0578	20.0600	20.0024	19.6072	18.9168	18.2872 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1819	18.4409	18.8937	19.3980	19.7457	19.8919	19.9078	19.9100	19.8524	19.4572	18.7668	18.1372 (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	0.9602	0.9402	0.8956	0.8025	0.6436	0.3989	0.2201	0.2393	0.5334	0.8167	0.9311	0.9662	(94)
Useful gains	760.9060	844.2925	893.7290	883.6327	726.7469	454.8365	239.3894	250.5046	524.8977	714.3774	735.8921	720.1691	(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	1588.3405	1552.6275	1389.7407	1141.7132	810.8675	464.4950	240.0454	251.4118	555.2624	941.0130	1289.4901	1570.1458	(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	615.6113	476.0011	369.0327	185.8180	62.5857	0.0000	0.0000	0.0000	0.0000	168.6168	398.5905	632.3826	(98)
Space heating												2908.6388	(98)
Space heating per m2											(98) / (4) =	31.7468	(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													3213.9655 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	615.6113	476.0011	369.0327	185.8180	62.5857	0.0000	0.0000	0.0000	0.0000	168.6168	398.5905	632.3826	(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)	680.2334	525.9681	407.7710	205.3237	69.1555	0.0000	0.0000	0.0000	0.0000	186.3169	440.4315	698.7653	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.4719	110.6481	88.6276	43.6675	19.7304	0.0000	0.0000	19.2722	43.0725	87.9898	122.0324	145.0964	(64)
Efficiency of water heater	89.8703	89.8786	89.8621	89.8731	89.7118	87.3000	87.3000	87.3000	87.3000	89.3766	89.7291	87.3000	(216)
(217)m	89.8703	89.8786	89.8621	89.8731	89.7118	87.3000	87.3000	87.3000	87.3000	89.3766	89.7291	87.3000	(217)
Fuel for water heating, kWh/month	161.8687	123.1084	98.6262	48.5879	21.9931	0.0000	0.0000	22.0758	49.3385	98.4484	136.0009	161.4243	(219)
Water heating fuel used												921.4722	(219)
Annual totals kWh/year													
Space heating fuel - main system												3213.9655	(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)													389.0105 (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												2825.2886	(238)

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

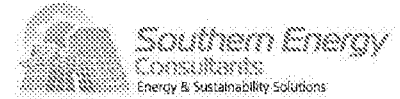
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3213.9655	3.8700	124.3805	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	921.4722	3.8700	35.6610	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	389.0105	18.9000	73.5230	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			5.4233	(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	3213.9655	0.2160	694.2166	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	921.4722	0.2160	199.0380	(264)
Space and water heating			893.2546	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	389.0105	0.5190	201.8964	(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			213.2872 (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	3213.9655	1.2200	3921.0380 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	921.4722	1.2200	1124.1961 (264)
Space and water heating			5045.2341 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	389.0105	3.0700	1194.2622 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1023.0762 (272)
Primary energy kWh/m2/year			11.1665 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	South
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	292.74 (P1)
Transmission heat loss coefficient	79.42 (37)
Summer heat loss coefficient	372.16 (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	0.4800	81.1852	0.4400	0.0000	0.9000	15.4317
East	5.1600	117.5071	0.4400	0.0000	0.9000	240.1092
South	6.9700	112.2060	0.4400	0.0000	0.9000	309.7020
West	3.9300	117.5071	0.4400	0.0000	0.9000	182.8739

total: 748.1168

	Jun	Jul	Aug	
Solar gains	787	748	690	(P4)
Internal gains	464	445	453	
Total summer gains	1251	1193	1144	(P5)
Summer gain/loss ratio	3.36	3.21	3.07	(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	20.01	21.75	21.52	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			