

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG001c			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Det Br Th Ea Ga		
Property	Holywell, Plot 21				
SAP Rating	85 B	DER	15.97	TET	16.44
Environmental	36 B	% DER<TER	2.84		
CO ₂ Emissions (t/year)	1.69	DPEE	49.19	TPEE	53.99
General Requirements Compliance	Pass	% DPEE<TPEE	8.88		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 129 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) 16.44 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.97 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 54.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 49.2 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

Overshading: Average
Windows facing North East: 0.60 m², No overhang
Windows facing South East: 8.11 m², No overhang
Windows facing North West: 10.07 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Thermal bridging y-value 0.035 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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.3102	151.9746	151.6456	150.1003	149.8112	148.4653	148.4653	148.2160	148.9837	149.8112	150.3961	151.0075 (39)
Average = Sum(39)m / 12 =												150.0989 (39)
HLP	1.1811	1.1785	1.1759	1.1639	1.1617	1.1513	1.1513	1.1493	1.1553	1.1617	1.1662	1.1710 (40)
HLP (average)												1.1639 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (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 =	1618.8725 (45)
Distribution loss (46)m = 0.15 x (45)m	25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720	14.1467 (61)	
Total heat required for water heating calculated for each month	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (62)	
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)	
	Solar input (sum of months) = Sum(63)m =											0.0000 (63)	
Output from w/h	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)	
	Total per year (kWh/year) = Sum(64)m =											1784.6736 (64)	
Heat gains from water heating, kWh/month	59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	473.7289	471.2807	453.9207	425.7615	396.6791	369.1606	351.6389	358.4011	373.1975	401.5921	434.1631	459.0584	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				0.6000	11.2829		0.4400		0.0000		0.7700		2.2936 (75)
Southeast				8.1100	36.7938		0.4400		0.0000		0.7700		101.0972 (77)
Northwest				10.0700	11.2829		0.4400		0.0000		0.7700		38.4942 (81)
Solar gains	141.8850	255.2307	385.2039	537.6044	657.2174	676.6818	642.3154	549.3765	437.3970	291.7871	172.4128	119.8275	(83)
Total gains	615.6139	726.5114	839.1246	963.3659	1053.8965	1045.8424	993.9544	907.7776	810.5944	693.3792	606.5759	578.8859	(84)

7. Mean internal temperature (heating season)

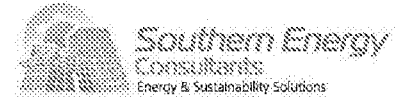
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.5789	43.6751	43.7699	44.2205	44.3058	44.7075	44.7075	44.7827	44.5519	44.3058	44.1335	43.9548
alpha	3.9053	3.9117	3.9180	3.9480	3.9537	3.9805	3.9805	3.9855	3.9701	3.9537	3.9422	3.9303
util living area	0.9970	0.9939	0.9857	0.9598	0.8922	0.7592	0.6089	0.6725	0.8812	0.9770	0.9946	0.9977 (86)
MIT	19.2455	19.4311	19.7514	20.1863	20.5863	20.8570	20.9560	20.9347	20.7131	20.1958	19.6433	19.2145 (87)
Th 2	19.9352	19.9373	19.9393	19.9490	19.9508	19.9592	19.9592	19.9608	19.9560	19.9508	19.9471	19.9433 (88)
util rest of house	0.9962	0.9923	0.9816	0.9473	0.8563	0.6784	0.4852	0.5513	0.8270	0.9677	0.9929	0.9971 (89)
MIT 2	17.5808	17.8529	18.3204	18.9520	19.5046	19.8437	19.9371	19.9242	19.6853	18.9746	18.1702	17.5407 (90)
Living area fraction	17.7843	18.0458	18.4953	19.1028	19.6368	19.9675	20.0616	20.0477	19.8109	19.1238	18.3503	17.7453 (92)
MIT	17.6343	17.8958	18.3453	18.9528	19.4868	19.8175	19.9116	19.8977	19.6609	18.9738	18.2003	17.5953 (93)
Temperature adjustment												-0.1500
adjusted MIT												

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9934	0.9873	0.9723	0.9310	0.8365	0.6657	0.4790	0.5431	0.8074	0.9547	0.9882	0.9948 (94)
Useful gains	611.5469	717.2579	815.9105	896.9150	881.5935	696.2326	476.1114	493.0137	654.4927	661.9642	599.3917	575.8554 (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	2030.9441	1975.0301	1796.2895	1508.9290	1166.5497	774.6171	491.6583	518.4120	828.4884	1254.4948	1669.4358	2022.7873 (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	1056.0315	845.2229	729.4020	440.6501	212.0074	0.0000	0.0000	0.0000	0.0000	440.8428	770.4317	1076.5173 (98)
Space heating												5571.1057 (98)
Space heating per m2												(98) / (4) = 43.2003 (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													6155.9179	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	1056.0315	845.2229	729.4020	440.6501	212.0074	0.0000	0.0000	0.0000	0.0000	440.8428	770.4317	1076.5173	(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)	1166.8856	933.9480	805.9690	486.9062	234.2623	0.0000	0.0000	0.0000	0.0000	487.1191	851.3058	1189.5219	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)	
Efficiency of water heater (217)m	90.0149	89.9762	89.8903	89.6832	89.1954	87.3000	87.3000	87.3000	87.3000	89.6606	89.9234	90.0347	(217)	
Fuel for water heating, kWh/month	202.1907	177.3509	184.2250	162.4542	157.8216	140.7841	132.0841	149.2571	150.3538	168.6485	181.6607	196.2500	(219)	
Water heating fuel used												2003.0807	(219)	
Annual totals kWh/year														
Space heating fuel - main system													6155.9179	(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)													496.5096	(232)
Total delivered energy for all uses													8730.5082	(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	6155.9179	0.2160	1329.6783 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2003.0807	0.2160	432.6654 (264)
Space and water heating			1762.3437 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total CO2, kg/year			2058.9572 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.9700 (273)

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

DER		15.9700	ZC1
Total Floor Area	TFA	128.9600	
Assumed number of occupants	N	2.8922	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.6226	ZC2
CO2 emissions from cooking, equation (L16)		1.4610	ZC3
Total CO2 emissions		31.0537	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		31.0537	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.3258	24.8977		(27)
Heat Loss Floor 1			64.4800	0.1300	8.3824		(28a)
Brick Cavity	120.4500	19.7100	100.7400	0.1800	18.1332		(29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.1800	6.0192		(29a)
Main Plane	64.4800		64.4800	0.1300	8.3824		(30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	70.5449		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3550 (36)
Total fabric heat loss						(33) + (36) =	82.8999 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	142.9310	142.5953	142.2663	140.7210	140.4319	139.0860	139.0860	138.8368	139.6044	140.4319	141.0168	141.6283 (39)
Average = Sum(39)m / 12 =												140.7196 (39)
HLP	1.1083	1.1057	1.1032	1.0912	1.0890	1.0785	1.0785	1.0766	1.0825	1.0890	1.0935	1.0982 (40)
HLP (average)												1.0912 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)
Energy content (annual)										Total = Sum(45)m =		1618.8725 (45)
Distribution loss (46)m = 0.15 x (45)m												
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	50.9589	49.3151	49.2861	45.6666	47.1888	49.2861	49.3151	50.9589	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	165.5611	166.9787	188.0846	198.9984	213.5054 (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	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	Solar input (sum of months) = Sum(63)m = 0.0000 (63)				213.5054 (64)
Heat gains from water heating, kWh/month	68.5473	60.3165	63.1070	56.2401	54.4555	47.7751	45.4886	50.9829	51.4519	58.3340	62.0985	66.7864 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	92.1335	89.7568	84.8212	78.1113	73.1929	66.3543	61.1407	68.5255	71.4610	78.4059	86.2479	89.7667	(72)
Total internal gains	486.0943	483.6504	466.2993	438.1522	408.5190	380.3102	362.7972	370.2491	385.6002	413.9823	446.5392	471.4281	(73)

6. Solar gains

[Jan]			Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W					
Northeast			0.6000	11.2829	0.6300	0.7000	0.7700	2.0689	(75)				
Southeast			8.1100	36.7938	0.6300	0.7000	0.7700	91.1943	(77)				
Northwest			10.0700	11.2829	0.6300	0.7000	0.7700	34.7235	(81)				
Solar gains	127.9867	230.2297	347.4714	484.9436	592.8399	610.3978	579.3977	495.5625	394.5520	263.2052	155.5242	108.0899	(83)
Total gains	614.0810	713.8802	813.7707	923.0958	1001.3589	990.7079	942.1949	865.8116	780.1521	677.1876	602.0633	579.5180	(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	62.6565	62.8040	62.9492	63.6405	63.7715	64.3886	64.3886	64.5042	64.1495	63.7715	63.5070	63.2328	
alpha	5.1771	5.1869	5.1966	5.2427	5.2514	5.2926	5.2926	5.3003	5.2766	5.2514	5.2338	5.2155	
util living area	0.9993	0.9984	0.9952	0.9811	0.9286	0.7929	0.6247	0.6924	0.9148	0.9904	0.9986	0.9995	(86)
MIT	19.6987	19.8378	20.0796	20.4132	20.7230	20.9228	20.9827	20.9711	20.8160	20.4184	20.0001	19.6766	(87)
Th 2	19.9940	19.9962	19.9982	20.0080	20.0099	20.0184	20.0184	20.0200	20.0151	20.0099	20.0062	20.0023	(88)
util rest of house	0.9991	0.9978	0.9933	0.9731	0.8968	0.7086	0.4978	0.5664	0.8636	0.9852	0.9980	0.9994	(89)
MIT 2	18.2425	18.4474	18.8019	19.2912	19.7198	19.9626	20.0115	20.0068	19.8509	19.3041	18.6922	18.2160	(90)
Living area fraction	18.4205	18.6173	18.9581	19.4283	19.8424	20.0799	20.1302	20.1247	19.9688	19.4403	18.8521	18.3945	(92)
MIT	18.4205	18.6173	18.9581	19.4283	19.8424	20.0799	20.1302	20.1247	19.9688	19.4403	18.8521	18.3945	(93)
Temperature adjustment	18.4205	18.6173	18.9581	19.4283	19.8424	20.0799	20.1302	20.1247	19.9688	19.4403	18.8521	18.3945	(93)
adjusted MIT	18.4205	18.6173	18.9581	19.4283	19.8424	20.0799	20.1302	20.1247	19.9688	19.4403	18.8521	18.3945	(93)

8. Space heating requirement

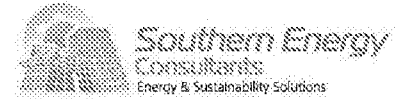
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9985	0.9966	0.9905	0.9667	0.8902	0.7145	0.5131	0.5810	0.8605	0.9807	0.9968	0.9989	(94)
Useful gains	613.1780	711.4440	806.0017	892.3660	891.4003	707.8716	483.4070	503.0113	671.3437	664.1290	600.1454	578.8897	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
Month Fracti	2018.2535	1956.0204	1772.3631	1481.5556	1143.4546	762.1842	491.0006	517.1190	819.3172	1241.4616	1657.2375	2010.3393	(97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating	1045.3761	836.3554	718.9729	424.2165	187.5284	0.0000	0.0000	0.0000	0.0000	429.5355	761.1063	1064.9985	(98)
Space heating												5468.0896	(98)
Space heating per m2													(98) / (4) = 42.4014 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												5854.4856 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1045.3761	836.3554	718.9729	424.2165	187.5284	0.0000	0.0000	0.0000	0.0000	429.5355	761.1063	1064.9985 (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)	1119.2464	895.4554	769.7783	454.1932	200.7798	0.0000	0.0000	0.0000	0.0000	459.8881	814.8890	1140.2553 (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	218.8014	192.8235	202.4393	181.3794	176.0049	155.0153	148.5165	165.5611	166.9787	188.0846	198.9984	213.5054 (64)
Efficiency of water heater (217)m	88.4740	88.3187	87.9690	87.1181	85.2110	80.3000	80.3000	80.3000	80.3000	87.0651	88.1032	88.5403 (217)
Fuel for water heating, kWh/month	247.3059	218.3268	230.1256	208.1993	206.5518	193.0452	184.9520	206.1782	207.9436	216.0275	225.8698	241.1393 (219)
Water heating fuel used												2585.6650 (219)
Annual totals kWh/year												
Space heating fuel - main system												5854.4856 (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)												496.5096 (232)
Total delivered energy for all uses												9011.6602 (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	5854.4856	0.2160	1264.5689 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2585.6650	0.2160	558.5036 (264)
Space and water heating			1823.0725 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total CO2, kg/m2/year			2119.6860 (272)
Emissions per m2 for space and water heating			14.1367 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			1.9982 (272b)
Emissions per m2 for pumps and fans			0.3018 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.1367 * 1.00) + 1.9982 + 0.3018, rounded to 2 d.p.			16.4400 (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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) = 0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			9.0000	580.3200 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23314.7100 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							180.7902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss							(33) + (36) = 92.2792 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.3102	151.9746	151.6456	150.1003	149.8112	148.4653	148.4653	148.2160	148.9837	149.8112	150.3961	151.0075 (39)
Average = Sum(39)m / 12 =												150.0989 (39)
HLP	1.1811	1.1785	1.1759	1.1639	1.1617	1.1513	1.1513	1.1493	1.1553	1.1617	1.1662	1.1710 (40)
HLP (average)												1.1639 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (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 = 1618.8725 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.6665	31.1942	32.1896	28.0637	26.9278	23.2366	21.5321	24.7084	25.0035	29.1392	31.8077	34.5411 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	47.9389	46.4199	43.2656	38.9773	36.1932	32.2731	28.9410	33.2103	34.7271	39.1656	44.1774	46.4262	(72)
Total internal gains	438.8996	437.3136	421.7437	396.0182	368.5193	343.2289	327.5976	331.9339	345.8663	371.7420	401.4687	425.0877	(73)

6. Solar gains

[Jan]			Area m2		Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast			0.6000		11.2829		0.4400		0.0000		0.7700		2.2936 (75)
Southeast			8.1100		36.7938		0.4400		0.0000		0.7700		101.0972 (77)
Northwest			10.0700		11.2829		0.4400		0.0000		0.7700		38.4942 (81)
Solar gains	141.8850	255.2307	385.2039	537.6044	657.2174	676.6818	642.3154	549.3765	437.3970	291.7871	172.4128	119.8275	(83)
Total gains	580.7847	692.5443	806.9476	933.6226	1025.7366	1019.9108	969.9130	881.3103	783.2633	663.5291	573.8814	544.9152	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)	
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	42.5205	42.6144	42.7069	43.1465	43.2298	43.6217	43.6217	43.6951	43.4699	43.2298	43.0617	42.8873	
alpha	3.8347	3.8410	3.8471	3.8764	3.8820	3.9081	3.9081	3.9130	3.8980	3.8820	3.8708	3.8592	
util living area	0.9973	0.9944	0.9865	0.9617	0.8964	0.7671	0.6187	0.6841	0.8879	0.9788	0.9951	0.9979	(86)
MIT	19.1818	19.3717	19.7000	20.1466	20.5595	20.8436	20.9505	20.9264	20.6904	20.1552	19.5888	19.1509	(87)
Th 2	19.9352	19.9373	19.9393	19.9490	19.9508	19.9592	19.9592	19.9608	19.9560	19.9508	19.9471	19.9433	(88)
util rest of house	0.9966	0.9929	0.9827	0.9498	0.8620	0.6878	0.4949	0.5637	0.8364	0.9703	0.9936	0.9974	(89)
MIT 2	18.2667	18.4576	18.7856	19.2319	19.6236	19.8715	19.9418	19.9319	19.7536	19.2469	18.6822	18.2419	(90)
Living area fraction	18.3786	18.5693	18.8973	19.3437	19.7380	19.9903	20.0650	20.0534	19.8681	19.3579	18.7930	18.3530	(91)
MIT	18.3786	18.5693	18.8973	19.3437	19.7380	19.9903	20.0650	20.0534	19.8681	19.3579	18.7930	18.3530	(92)
Temperature adjustment	18.3786	18.5693	18.8973	19.3437	19.7380	19.9903	20.0650	20.0534	19.8681	19.3579	18.7930	18.3530	(93)
adjusted MIT	18.3786	18.5693	18.8973	19.3437	19.7380	19.9903	20.0650	20.0534	19.8681	19.3579	18.7930	18.3530	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	577.9513	685.7200	788.8562	878.5765	875.5383	704.2794	493.2262	507.3319	650.8737	639.4142	568.7926	542.8326	(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	2144.3102	2077.3867	1879.9991	1567.5963	1204.1802	800.2706	514.4358	541.4973	859.3456	1312.0342	1758.5752	2137.2091	(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	1165.3710	935.2001	811.8103	496.0943	244.5096	0.0000	0.0000	0.0000	0.0000	500.4293	856.6435	1186.2161	(98)
Space heating												6196.2741	(98)
Space heating per m2												48.0480	(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	1395.5736	1098.6430	1126.4419	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7707	0.8442	0.8043	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1075.5371	927.4631	905.9468	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1311.0984	1250.0279	1148.9342	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	169.6042	239.9882	180.7826	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												590.3750 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	42.4010	59.9971	45.1956	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												147.5937 (107)
Space cooling per m2												1.1445 (108)
Energy for space heating												48.0480 (99)
Energy for space cooling												1.1445 (108)
Total												49.1925 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.2 (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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.3258	24.8977		(27)
Heat Loss Floor 1			64.4800	0.1300	8.3824		(28a)
Brick Cavity	120.4500	19.7100	100.7400	0.1800	18.1332		(29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.1800	6.0192		(29a)
Main Plane	64.4800		64.4800	0.1300	8.3824		(30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		70.5449		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							12.3550 (36)
Total fabric heat loss						(33) + (36) =	82.8999 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	142.9310	142.5953	142.2663	140.7210	140.4319	139.0860	139.0860	138.8368	139.6044	140.4319	141.0168	141.6283 (39)
Average = Sum(39)m / 12 =												140.7196 (39)
HLP	1.1083	1.1057	1.1032	1.0912	1.0890	1.0785	1.0785	1.0766	1.0825	1.0890	1.0935	1.0982 (40)
HLP (average)												1.0912 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)
Energy content (annual)										Total = Sum(45)m =		1618.8725 (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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Calculation Type: New Build (As Designed)

CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	35.6665	31.1942	32.1896	28.0637	26.9278	23.2366	21.5321	24.7084	25.0035	29.1392	31.8077	34.5411 (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	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	144.6122	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	28.1144	24.9710	20.3078	15.3743	11.4925	9.7024	10.4838	13.6272	18.2905	23.2239	27.1058	28.8958	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	296.4627	299.5390	291.7867	275.2830	254.4499	234.8698	221.7891	218.7127	226.4651	242.9688	263.8019	283.3820	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	37.4612	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	47.9389	46.4199	43.2656	38.9773	36.1932	32.2731	28.9410	33.2103	34.7271	39.1656	44.1774	46.4262	(72)
Total internal gains	438.8996	437.3136	421.7437	396.0182	368.5193	343.2289	327.5976	331.9339	345.8663	371.7420	401.4687	425.0877	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	0.6000	11.2829	0.6300	0.7000	0.7700	2.0689 (75)
Southeast	8.1100	36.7938	0.6300	0.7000	0.7700	91.1943 (77)
Northwest	10.0700	11.2829	0.6300	0.7000	0.7700	34.7235 (81)

Solar gains	127.9867	230.2297	347.4714	484.9436	592.8399	610.3978	579.3977	495.5625	394.5520	263.2052	155.5242	108.0899 (83)
Total gains	566.8864	667.5433	769.2151	880.9618	961.3592	953.6267	906.9953	827.4964	740.4182	634.9472	556.9928	533.1775 (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	62.6565	62.8040	62.9492	63.6405	63.7715	64.3886	64.3886	64.5042	64.1495	63.7715	63.5070	63.2328
alpha	5.1771	5.1869	5.1966	5.2427	5.2514	5.2926	5.2926	5.3003	5.2766	5.2514	5.2338	5.2155
util living area	0.9996	0.9988	0.9963	0.9845	0.9381	0.8108	0.6449	0.7163	0.9286	0.9928	0.9990	0.9997 (86)
MIT	19.6642	19.8040	20.0477	20.3850	20.7023	20.9137	20.9800	20.9661	20.7967	20.3887	19.9671	19.6426 (87)
Th 2	19.9940	19.9962	19.9982	20.0080	20.0099	20.0184	20.0184	20.0200	20.0151	20.0099	20.0062	20.0023 (88)
util rest of house	0.9994	0.9984	0.9948	0.9778	0.9093	0.7286	0.5159	0.5896	0.8828	0.9888	0.9986	0.9996 (89)
MIT 2	18.7637	18.9051	19.1498	19.4914	19.7943	19.9750	20.0128	20.0092	19.8882	19.4991	19.0762	18.7487 (90)
Living area fraction									fLA = Living area / (4) =			0.1222 (91)
MIT	18.8737	19.0149	19.2595	19.6007	19.9052	20.0897	20.1310	20.1261	19.9992	19.6078	19.1851	18.8579 (92)
Temperature adjustment												0.0000
adjusted MIT	18.8737	19.0149	19.2595	19.6007	19.9052	20.0897	20.1310	20.1261	19.9992	19.6078	19.1851	18.8579 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9991	0.9978	0.9933	0.9741	0.9056	0.7353	0.5316	0.6047	0.8818	0.9865	0.9981	0.9994 (94)
Useful gains	566.3971	666.0850	764.0744	858.1604	870.5834	701.2303	482.1702	500.3613	652.9242	626.3591	555.9152	532.8471 (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	2083.0383	2012.7203	1815.2487	1505.8066	1152.2757	763.5402	491.1188	517.3216	823.5564	1264.9804	1704.2020	2075.9793 (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	1128.3811	904.9389	782.0737	466.3052	209.5791	0.0000	0.0000	0.0000	0.0000	475.1343	826.7665	1148.0904 (98)
Space heating												5941.2692 (98)
Space heating per m2										(98) / (4) =		46.0706 (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	1307.4084	1029.2364	1055.1593	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8157	0.8916	0.8532	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1066.4229	917.6535	900.2131	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1233.6236	1176.4877	1086.0348	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												

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	0.0000	0.0000	0.0000	0.0000	0.0000	120.3845	192.5727	138.2513	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												451.2085 (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	30.0961	48.1432	34.5628	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												112.8021 (107)
Space cooling per m2												0.8747 (108)
Energy for space heating												46.0706 (99)
Energy for space cooling												0.8747 (108)
Total												46.9453 (109)
Target Fabric Energy Efficiency (TFEE)												54.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.5287	148.9837	148.9837	148.2160	148.2160	147.2855	147.5082	147.0695	147.2855	147.7375	147.7375	148.4653 (39)
Average = Sum(39)m / 12 =												148.0848 (39)
HLP	1.1595	1.1553	1.1553	1.1493	1.1493	1.1421	1.1438	1.1404	1.1421	1.1456	1.1456	1.1513 (40)
HLP (average)												1.1483 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

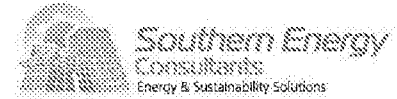
Elmhurst Energy Systems

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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 (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 (57)
Combi loss	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554 (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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554 (64)
RHI water heating demand											Total per year (kWh/year) = Sum(64)m = 1784.6736 (64)
Heat gains from water heating, kWh/month	59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877 (65)
											1785 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	0.6000				12.9236		0.4400		0.0000		0.7700		2.6271 (75)	
Southeast	8.1100				40.4699		0.4400		0.0000		0.7700		111.1979 (77)	
Northwest	10.0700				12.9236		0.4400		0.0000		0.7700		44.0915 (81)	
Solar gains	157.9165	256.4163	384.3249	555.7072	663.5995	731.6530	686.8321	599.7245	474.1266	313.5875	196.7516	131.9815 (83)		
Total gains	866.5429	959.3945	1059.1300	1186.8242	1249.5503	1277.7563	1210.1430	1132.9976	1033.0092	916.3937	848.2126	820.6667 (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	44.3895	44.5519	44.5519	44.7827	44.7827	45.0656	44.9976	45.1318	45.0656	44.9277	44.9277	44.7075
alpha	3.9593	3.9701	3.9701	3.9855	3.9855	4.0044	3.9998	4.0088	4.0044	3.9952	3.9952	3.9805
util living area	0.9882	0.9815	0.9622	0.9057	0.7779	0.5476	0.3730	0.4081	0.7180	0.9261	0.9783	0.9902 (86)
MIT	19.6102	19.7629	20.0790	20.4777	20.8043	20.9664	20.9946	20.9924	20.8967	20.5050	20.0003	19.5831 (87)
Th 2	19.9525	19.9560	19.9560	19.9608	19.9608	19.9666	19.9652	19.9680	19.9666	19.9638	19.9638	19.9592 (88)
util rest of house	0.9852	0.9767	0.9518	0.8791	0.7166	0.4462	0.2510	0.2802	0.6254	0.8990	0.9716	0.9876 (89)
MIT 2	18.1231	18.3463	18.8006	19.3601	19.7780	19.9477	19.9640	19.9660	19.8913	19.4110	18.6974	18.0882 (90)
Living area fraction	fLA = Living area / (4) =											0.1222 (91)
MIT	18.3048	18.5194	18.9569	19.4967	19.9034	20.0722	20.0899	20.0915	20.0142	19.5447	18.8566	18.2709 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1548	18.3694	18.8069	19.3467	19.7534	19.9222	19.9399	19.9415	19.8642	19.3947	18.7066	18.1209 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9773	0.9662	0.9363	0.8596	0.7027	0.4416	0.2479	0.2768	0.6150	0.8795	0.9597	0.9807 (94)
Useful gains	846.8514	926.9191	991.6355	1020.1394	878.0202	564.2472	300.0404	313.6012	635.3394	805.9894	814.0692	804.8475 (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	1952.0680	1902.4328	1699.4350	1400.1475	1000.9689	577.6773	300.9057	314.9459	686.9716	1151.5706	1581.7655	1933.1552 (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	822.2811	655.5452	526.6028	273.6059	91.4738	0.0000	0.0000	0.0000	0.0000	257.1124	552.7414	839.4609 (98)
Space heating												4018.8235 (98)
RHI space heating demand												4019 (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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.3102	151.9746	151.6456	150.1003	149.8112	148.4653	148.4653	148.2160	148.9837	149.8112	150.3961	151.0075 (39)
Average = Sum(39)m / 12 =												150.0989 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1811	1.1785	1.1759	1.1639	1.1617	1.1513	1.1513	1.1493	1.1553	1.1617	1.1662	1.1710 (40)
HLP (average)												1.1639 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (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 = 1618.8725 (45)											
Distribution loss (46)m = 0.15 x (45)m												
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820	(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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720	(61)
Total heat required for water heating calculated for each month												
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(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												
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Heat gains from water heating, kWh/month												
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834	(65)
Total per year (kWh/year) = Sum(64)m =	1784.6736 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	0.6000	11.2829	0.4400	0.0000	0.7700	2.2936 (75)
Southeast	8.1100	36.7938	0.4400	0.0000	0.7700	101.0972 (77)
Northwest	10.0700	11.2829	0.4400	0.0000	0.7700	38.4942 (81)

Solar gains	141.8850	255.2307	385.2039	537.6044	657.2174	676.6818	642.3154	549.3765	437.3970	291.7871	172.4128	119.8275	(83)
Total gains	850.5114	958.2090	1060.0090	1168.7214	1243.1682	1222.7851	1165.6264	1082.6495	996.2795	894.5933	823.8737	808.5128	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	43.5789	43.6751	43.7699	44.2205	44.3058	44.7075	44.7075	44.7827	44.5519	44.3058	44.1335	43.9548	
alpha	3.9053	3.9117	3.9180	3.9480	3.9537	3.9805	3.9805	3.9855	3.9701	3.9537	3.9422	3.9303	
util living area	0.9907	0.9843	0.9695	0.9295	0.8409	0.6883	0.5344	0.5887	0.8111	0.9493	0.9844	0.9924	(86)
MIT	19.4536	19.6322	19.9339	20.3338	20.6823	20.9007	20.9722	20.9593	20.7989	20.3527	19.8328	19.4194	(87)
Th 2	19.9352	19.9373	19.9393	19.9490	19.9508	19.9592	19.9592	19.9608	19.9560	19.9508	19.9471	19.9433	(88)
util rest of house	0.9884	0.9803	0.9614	0.9099	0.7958	0.6041	0.4194	0.4728	0.7426	0.9312	0.9798	0.9904	(89)
MIT 2	17.8835	18.1440	18.5810	19.1535	19.6208	19.8829	19.9460	19.9395	19.7784	19.1913	18.4441	17.8391	(90)
Living area fraction	18.0754	18.3259	18.7463	19.2978	19.7505	20.0072	20.0714	20.0641	19.9031	19.3332	18.6138	18.0323	(91)
MIT	17.9254	18.1759	18.5963	19.1478	19.6005	19.8572	19.9214	19.9141	19.7531	19.1832	18.4638	17.8823	(92)
Temperature adjustment													-0.1500
adjusted MIT													17.8823 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	834.9063	930.1483	1004.0454	1041.0149	967.2787	727.5825	483.7148	505.8235	724.1329	816.8573	799.1678	796.0715	(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	2075.2907	2017.5987	1834.3506	1538.1921	1183.5900	780.5184	493.1107	520.8466	842.2214	1285.8667	1709.0737	2066.1238	(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	922.8459	730.7667	617.7471	357.9676	160.9356	0.0000	0.0000	0.0000	0.0000	348.9430	655.1323	944.9190	(98)
Space heating												4739.2571	(98)
Space heating per m2												36.7498	(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													5236.7482 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.8459	730.7667	617.7471	357.9676	160.9356	0.0000	0.0000	0.0000	0.0000	348.9430	655.1323	944.9190	(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)	1019.7193	807.4770	682.5935	395.5443	177.8294	0.0000	0.0000	0.0000	0.0000	385.5724	723.9031	1044.1094	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Efficiency of water heater (217)m	89.9568	89.9093	89.8041	89.5505	88.9782	87.3000	87.3000	87.3000	87.3000	89.5081	89.8427	89.9804	(217)
Fuel for water heating, kWh/month	202.3213	177.4829	184.4019	162.6949	158.2067	140.7841	132.0841	149.2571	150.3538	168.9359	181.8237	196.3684	(219)
Water heating fuel used												2004.7148	(219)
Annual totals kWh/year													
Space heating fuel - main system												5236.7482	(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)												496.5096	(232)
Total delivered energy for all uses												7812.9726	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	5236.7482	3.4800	182.2388	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	2004.7148	3.4800	69.7641	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	496.5096	13.1900	65.4896	(250)
Additional standing charges			120.0000	(251)
Total energy cost			447.3850	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)	$[(255) \times (256)] / [(4) + 45.0] =$		1.0801 (257)
SAP value			84.9320
SAP rating (Section 12)			85 (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	5236.7482	0.2160	1131.1376	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2004.7148	0.2160	433.0184	(264)
Space and water heating			1564.1560	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	496.5096	0.5190	257.6885	(268)
Total kg/year			1860.7695	(272)
CO2 emissions per m2			14.4300	(273)
EI value			85.6666	
EI rating			86	(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	$3.48 / 0.8889 = 3.915$, stars = 4
Water heating environmental impact	$0.216 / 0.8889 = 0.2430$, stars = 4

FULL SAP CALCULATION PRINTOUT

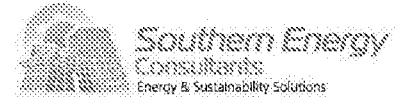
Calculation Type: New Build (As Designed)



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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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)	=	0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss							(33) + (36) = 92.2792 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.5287	148.9837	148.9837	148.2160	148.2160	147.2855	147.5082	147.0695	147.2855	147.7375	147.7375	148.4653 (39)
Average = Sum(39)m / 12 =												148.0848 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1595	1.1553	1.1553	1.1493	1.1493	1.1421	1.1438	1.1404	1.1421	1.1456	1.1456	1.1513 (40)
HLP (average)												1.1483 (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	2.8922 (42)
Average daily hot water use (litres/day)	102.8908 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764 22.0194 22.7221 19.8096 19.0078 16.4023 15.1991 17.4412 17.6495 20.5688 22.4525 24.3820 (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 (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 (57)											
Combi loss 14.1594 12.7776 14.1201 13.6298 14.0507 13.5558 13.9818 14.0265 13.5952 14.0857 13.6720 14.1467 (61)											
Total heat required for water heating calculated for each month											
182.0018 159.5737 165.6005 145.6940 140.7695 122.9045 115.3094 130.3014 131.2588 151.2113 163.3554 176.6931 (62)											
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)											
Solar input (sum of months) = Sum(63)m = 0.0000 (63)											
Output from w/h											
182.0018 159.5737 165.6005 145.6940 140.7695 122.9045 115.3094 130.3014 131.2588 151.2113 163.3554 176.6931 (64)											
Heat gains from water heating, kWh/month											
59.3475 52.0041 53.8973 47.3188 45.6467 39.7474 37.1869 42.1680 42.5220 49.1157 53.1877 57.5834 (65)											
Total per year (kWh/year) = Sum(64)m = 1784.6736 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	0.6000				12.9236		0.4400		0.0000		0.7700		2.6271 (75)	
Southeast	8.1100				40.4699		0.4400		0.0000		0.7700		111.1979 (77)	
Northwest	10.0700				12.9236		0.4400		0.0000		0.7700		44.0915 (81)	
Solar gains	157.9165	256.4163	384.3249	555.7072	663.5995	731.6530	686.8321	599.7245	474.1266	313.5875	196.7516	131.9815 (83)		
Total gains	866.5429	959.3945	1059.1300	1186.8242	1249.5503	1277.7563	1210.1430	1132.9976	1033.0092	916.3937	848.2126	820.6667 (84)		

7. Mean internal temperature (heating season)

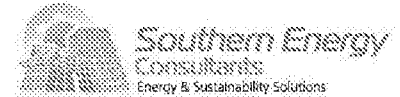
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	44.3895	44.5519	44.5519	44.7827	44.7827	45.0656	44.9976	45.1318	45.0656	44.9277	44.9277	44.7075
alpha	3.9593	3.9701	3.9701	3.9855	3.9855	4.0044	3.9998	4.0088	4.0044	3.9952	3.9952	3.9805
util living area	0.9882	0.9815	0.9622	0.9057	0.7779	0.5476	0.3730	0.4081	0.7180	0.9261	0.9783	0.9902 (86)
MIT	19.6102	19.7629	20.0790	20.4777	20.8043	20.9664	20.9946	20.9924	20.8967	20.5050	20.0003	19.5831 (87)
Th 2	19.9525	19.9560	19.9560	19.9608	19.9608	19.9666	19.9652	19.9680	19.9666	19.9638	19.9638	19.9592 (88)
util rest of house	0.9852	0.9767	0.9518	0.8791	0.7166	0.4462	0.2510	0.2802	0.6254	0.8990	0.9716	0.9876 (89)
MIT 2	18.1231	18.3463	18.8006	19.3601	19.7780	19.9477	19.9640	19.9660	19.8913	19.4110	18.6974	18.0882 (90)
Living area fraction	18.3048	18.5194	18.9569	19.4967	19.9034	20.0722	20.0899	20.0915	20.0142	19.5447	18.8566	18.2709 (92)
MIT	18.1548	18.3694	18.8069	19.3467	19.7534	19.9222	19.9399	19.9415	19.8642	19.3947	18.7066	18.1209 (93)
Temperature adjustment												-0.1500
adjusted MIT												18.1209 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9773	0.9662	0.9363	0.8596	0.7027	0.4416	0.2479	0.2768	0.6150	0.8795	0.9597	0.9807	(94)
Useful gains	846.8514	926.9191	991.6355	1020.1394	878.0202	564.2472	300.0404	313.6012	635.3394	805.9894	814.0692	804.8475	(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	1952.0680	1902.4328	1699.4350	1400.1475	1000.9689	577.6773	300.9057	314.9459	686.9716	1151.5706	1581.7655	1933.1552	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	822.2811	655.5452	526.6028	273.6059	91.4738	0.0000	0.0000	0.0000	0.0000	257.1124	552.7414	839.4609	(98)
Space heating												4018.8235	(98)
Space heating per m2												31.1633	(99)
											(98) / (4) =		

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													4440.6889 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	822.2811	655.5452	526.6028	273.6059	91.4738	0.0000	0.0000	0.0000	0.0000	257.1124	552.7414	839.4609	(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)	908.5979	724.3593	581.8815	302.3269	101.0761	0.0000	0.0000	0.0000	0.0000	284.1021	610.7639	927.5811	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Efficiency of water heater (217)m	89.9028	89.8552	89.7133	89.3618	88.5330	87.3000	87.3000	87.3000	87.3000	89.2880	89.7495	89.9268	(216)
Fuel for water heating, kWh/month	202.4429	177.5898	184.5886	163.0383	159.0023	140.7841	132.0841	149.2571	150.3538	169.3524	182.0125	196.4854	(219)
Water heating fuel used												2006.9914	(219)
Annual totals kWh/year													
Space heating fuel - main system												4440.6889	(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)												496.5096	(232)
Total delivered energy for all uses												7019.1899	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4440.6889	3.8700	171.8547 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2006.9914	3.8700	77.6706 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	496.5096	18.9000	93.8403 (250)
Additional standing charges			93.0000 (251)
Total energy cost			450.5405 (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	4440.6889	0.2160	959.1888 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.9914	0.2160	433.5101 (264)
Space and water heating			1392.6989 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Total kg/year			1689.3124 (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	4440.6889	1.2200	5417.6405 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.9914	1.2200	2448.5295 (264)
Space and water heating			7866.1700 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	496.5096	3.0700	1524.2844 (268)
Primary energy kWh/year			9620.7044 (272)
Primary energy kWh/m2/year			74.6022 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 85
Current environmental impact rating: B 86

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	SAP increase too small
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
U Solar photovoltaic panels	+ 7.7	-£ 345	-947 kg (56.0%)

Measures omitted - SAP change or cost saving too small:	SAP change	Cost change	CO2 change
N Solar water heating	+ 0.9	-£ 30	-193 kg (11.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar photovoltaic panels	£345	7.34 kg/m²	A 93
Total Savings	£345	7.34 kg/m²	A 93
Potential energy efficiency rating:		A 93	
Potential environmental impact rating:			A 93

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	£108	£108	£0
Mains gas	£343	£343	£0
Space heating	£279	£279	£0
Water heating	£78	£78	£0
Lighting	£94	£94	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£451	£106	£345
Total cost of uses	£451	£106	£345
Delivered energy	54 kWh/m²	40 kWh/m²	14 kWh/m²
Carbon dioxide emissions	1.7 tonnes	0.7 tonnes	0.9 tonnes
CO2 emissions per m²	13 kg/m²	6 kg/m²	7 kg/m²
Primary energy	75 kWh/m²	31 kWh/m²	43 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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.4101	0.4021	0.3940	0.3538	0.3458	0.3056	0.3056	0.2975	0.3217	0.3458	0.3619	0.3780 (22b)
Effective ac	0.5841	0.5808	0.5776	0.5626	0.5598	0.5467	0.5467	0.5443	0.5517	0.5598	0.5655	0.5714 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	60.0310	59.6954	59.3664	57.8211	57.5320	56.1861	56.1861	55.9368	56.7045	57.5320	58.1169	58.7283 (38)
Heat transfer coeff	152.3102	151.9746	151.6456	150.1003	149.8112	148.4653	148.4653	148.2160	148.9837	149.8112	150.3961	151.0075 (39)
Average = Sum(39)m / 12 =												150.0989 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1811	1.1785	1.1759	1.1639	1.1617	1.1513	1.1513	1.1493	1.1553	1.1617	1.1662	1.1710 (40)
HLP (average)												1.1639 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (45)

Regs Region: England

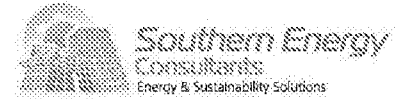
Elmhurst Energy Systems

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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (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											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast	0.6000	11.2829	0.4400	0.0000	0.7700	2.2936 (75)
Southeast	8.1100	36.7938	0.4400	0.0000	0.7700	101.0972 (77)
Northwest	10.0700	11.2829	0.4400	0.0000	0.7700	38.4942 (81)

Solar gains	141.8850	255.2307	385.2039	537.6044	657.2174	676.6818	642.3154	549.3765	437.3970	291.7871	172.4128	119.8275	(83)
Total gains	850.5114	958.2090	1060.0090	1168.7214	1243.1682	1222.7851	1165.6264	1082.6495	996.2795	894.5933	823.8737	808.5128	(84)

7. Mean internal temperature (heating season)

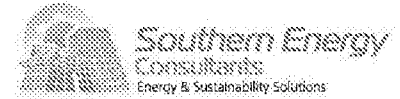
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	43.5789	43.6751	43.7699	44.2205	44.3058	44.7075	44.7075	44.7827	44.5519	44.3058	44.1335	43.9548
alpha	3.9053	3.9117	3.9180	3.9480	3.9537	3.9805	3.9805	3.9855	3.9701	3.9537	3.9422	3.9303
util living area	0.9907	0.9843	0.9695	0.9295	0.8409	0.6883	0.5344	0.5887	0.8111	0.9493	0.9844	0.9924 (86)
MIT	19.4536	19.6322	19.9339	20.3338	20.6823	20.9007	20.9722	20.9593	20.7989	20.3527	19.8328	19.4194 (87)
Th 2	19.9352	19.9373	19.9393	19.9490	19.9508	19.9592	19.9592	19.9608	19.9560	19.9508	19.9471	19.9433 (88)
util rest of house	0.9884	0.9803	0.9614	0.9099	0.7958	0.6041	0.4194	0.4728	0.7426	0.9312	0.9798	0.9904 (89)
MIT 2	17.8835	18.1440	18.5810	19.1535	19.6208	19.8829	19.9460	19.9395	19.7784	19.1913	18.4441	17.8391 (90)
Living area fraction	18.0754	18.3259	18.7463	19.2978	19.7505	20.0072	20.0714	20.0641	19.9031	19.3332	18.6138	18.0323 (91)
MIT	18.0754	18.3259	18.7463	19.2978	19.7505	20.0072	20.0714	20.0641	19.9031	19.3332	18.6138	18.0323 (92)
Temperature adjustment	17.9254	18.1759	18.5963	19.1478	19.6005	19.8572	19.9214	19.9141	19.7531	19.1832	18.4638	-0.1500
adjusted MIT	17.9254	18.1759	18.5963	19.1478	19.6005	19.8572	19.9214	19.9141	19.7531	19.1832	18.4638	17.8823 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	834.9063	930.1483	1004.0454	1041.0149	967.2787	727.5825	483.7148	505.8235	724.1329	816.8573	799.1678	796.0715	(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	2075.2907	2017.5987	1834.3506	1538.1921	1183.5900	780.5184	493.1107	520.8466	842.2214	1285.8667	1709.0737	2066.1238	(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	922.8459	730.7667	617.7471	357.9676	160.9356	0.0000	0.0000	0.0000	0.0000	348.9430	655.1323	944.9190	(98)
Space heating												4739.2571	(98)
Space heating per m2												36.7498	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 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													5236.7482 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	922.8459	730.7667	617.7471	357.9676	160.9356	0.0000	0.0000	0.0000	0.0000	348.9430	655.1323	944.9190	(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)	1019.7193	807.4770	682.5935	395.5443	177.8294	0.0000	0.0000	0.0000	0.0000	385.5724	723.9031	1044.1094	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)
Efficiency of water heater (217)m	89.9568	89.9093	89.8041	89.5505	88.9782	87.3000	87.3000	87.3000	87.3000	89.5081	89.8427	89.9804	(217)
Fuel for water heating, kWh/month	202.3213	177.4829	184.4019	162.6949	158.2067	140.7841	132.0841	149.2571	150.3538	168.9359	181.8237	196.3684	(219)
Water heating fuel used												2004.7148	(219)
Annual totals kWh/year													
Space heating fuel - main system													5236.7482 (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)													496.5096 (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													6085.7332 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	5236.7482	3.4800	182.2388 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2004.7148	3.4800	69.7641 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	496.5096	13.1900	65.4896 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			219.5622 (255)

11a. SAP rating - Individual heating systems

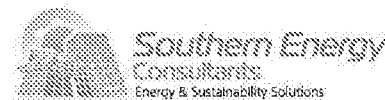
Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.5301 (257)
SAP value		92.6051
SAP rating (Section 12)		93 (258)
SAP band		A

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	5236.7482	0.2160	1131.1376 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2004.7148	0.2160	433.0184 (264)
Space and water heating			1564.1560 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			964.3322 (272)
CO2 emissions per m2			7.4800 (273)
EI value			92.5718
EI rating			93 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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	64.4800 (1b)	x 2.3000 (2b)	= 148.3040 (1b) - (3b)
First floor	64.4800 (1c)	x 2.5300 (2c)	= 163.1344 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	128.9600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	311.4384 (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) = 0.1284 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3784 (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) =		0.3217 (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	0.3378	0.3217	0.3217	0.2975	0.2975	0.2654	0.2734	0.2573	0.2654	0.2815	0.2815	0.3056 (22b)
Effective ac	0.5570	0.5517	0.5517	0.5443	0.5443	0.5352	0.5374	0.5331	0.5352	0.5396	0.5396	0.5467 (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)			18.7800	1.2357	23.2072		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			64.4800	0.1900	12.2512	75.0000	4836.0000 (28a)
Brick Cavity	120.4500	19.7100	100.7400	0.2500	25.1850	60.0000	6044.4000 (29a)
Tile Hung Cavity	36.8100	3.3700	33.4400	0.2400	8.0256	60.0000	2006.4000 (29a)
Main Plane	64.4800		64.4800	0.1100	7.0928	9.0000	580.3200 (30)
Total net area of external elements Aum(A, m ²)			286.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	82.2118		(33)
Internal Wall 1			85.0100			75.0000	6375.7500 (32c)
Internal Wall 2			192.3200			9.0000	1730.8800 (32c)
Internal Floor 1			64.4800			18.0000	1160.6400 (32d)
Internal Ceiling 1			64.4800			18.0000	1160.6400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	23895.0300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							185.2902 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.0674 (36)
Total fabric heat loss						(33) + (36) =	92.2792 (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	57.2495	56.7045	56.7045	55.9368	55.9368	55.0063	55.2290	54.7903	55.0063	55.4583	55.4583	56.1861 (38)
Heat transfer coeff	149.5287	148.9837	148.9837	148.2160	148.2160	147.2855	147.5082	147.0695	147.2855	147.7375	147.7375	148.4653 (39)
Average = Sum(39)m / 12 =												148.0848 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1595	1.1553	1.1553	1.1493	1.1493	1.1421	1.1438	1.1404	1.1421	1.1456	1.1456	1.1513 (40)
HLP (average)												1.1483 (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												2.8922 (42)
Average daily hot water use (litres/day)												102.8908 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	113.1798	109.0642	104.9486	100.8330	96.7173	92.6017	92.6017	96.7173	100.8330	104.9486	109.0642	113.1798 (44)
Energy conte	167.8424	146.7961	151.4804	132.0643	126.7188	109.3487	101.3277	116.2750	117.6637	137.1256	149.6834	162.5464 (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 = 1618.8725 (45)										
Distribution loss (46)m = 0.15 x (45)m											
25.1764	22.0194	22.7221	19.8096	19.0078	16.4023	15.1991	17.4412	17.6495	20.5688	22.4525	24.3820 (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	14.1594	12.7776	14.1201	13.6298	14.0507	13.5558	13.9818	14.0265	13.5952	14.0857	13.6720 (61)
Total heat required for water heating calculated for each month											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (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											
182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931 (64)
Heat gains from water heating, kWh/month											
59.3475	52.0041	53.8973	47.3188	45.6467	39.7474	37.1869	42.1680	42.5220	49.1157	53.1877	57.5834 (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	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	173.5346	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	70.2861	62.4275	50.7694	38.4357	28.7312	24.2561	26.2095	34.0681	45.7262	58.0599	67.7644	72.2395	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	442.4816	447.0732	435.5026	410.8701	379.7760	350.5520	331.0285	326.4369	338.0076	362.6400	393.7341	422.9582	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	55.2457	(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)	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	-115.6897	(71)
Water heating gains (Table 5)	79.7681	77.3870	72.4426	65.7206	61.3531	55.2047	49.9824	56.6775	59.0583	66.0157	73.8718	77.3970	(72)
Total internal gains	708.6263	702.9783	674.8051	631.1170	585.9508	546.1033	523.3110	533.2731	558.8826	602.8062	651.4610	688.6853	(73)

6. Solar gains

[Jan]														
	Area m2				Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W	
Northeast	0.6000				12.9236		0.4400		0.0000		0.7700		2.6271 (75)	
Southeast	8.1100				40.4699		0.4400		0.0000		0.7700		111.1979 (77)	
Northwest	10.0700				12.9236		0.4400		0.0000		0.7700		44.0915 (81)	
Solar gains	157.9165	256.4163	384.3249	555.7072	663.5995	731.6530	686.8321	599.7245	474.1266	313.5875	196.7516	131.9815 (83)		
Total gains	866.5429	959.3945	1059.1300	1186.8242	1249.5503	1277.7563	1210.1430	1132.9976	1033.0092	916.3937	848.2126	820.6667 (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	44.3895	44.5519	44.5519	44.7827	44.7827	45.0656	44.9976	45.1318	45.0656	44.9277	44.9277	44.7075
alpha	3.9593	3.9701	3.9701	3.9855	3.9855	4.0044	3.9998	4.0088	4.0044	3.9952	3.9952	3.9805
util living area	0.9882	0.9815	0.9622	0.9057	0.7779	0.5476	0.3730	0.4081	0.7180	0.9261	0.9783	0.9902 (86)
MIT	19.6102	19.7629	20.0790	20.4777	20.8043	20.9664	20.9946	20.9924	20.8967	20.5050	20.0003	19.5831 (87)
Th 2	19.9525	19.9560	19.9560	19.9608	19.9608	19.9666	19.9652	19.9680	19.9666	19.9638	19.9638	19.9592 (88)
util rest of house	0.9852	0.9767	0.9518	0.8791	0.7166	0.4462	0.2510	0.2802	0.6254	0.8990	0.9716	0.9876 (89)
MIT 2	18.1231	18.3463	18.8006	19.3601	19.7780	19.9477	19.9640	19.9660	19.8913	19.4110	18.6974	18.0882 (90)
Living area fraction	18.3048	18.5194	18.9569	19.4967	19.9034	20.0722	20.0899	20.0915	20.0142	19.5447	18.8566	18.2709 (91)
MIT	18.1548	18.3694	18.8069	19.3467	19.7534	19.9222	19.9399	19.9415	19.8642	19.3947	18.7066	18.1209 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.1548	18.3694	18.8069	19.3467	19.7534	19.9222	19.9399	19.9415	19.8642	19.3947	18.7066	18.1209 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9773	0.9662	0.9363	0.8596	0.7027	0.4416	0.2479	0.2768	0.6150	0.8795	0.9597	0.9807	(94)
Useful gains	846.8514	926.9191	991.6355	1020.1394	878.0202	564.2472	300.0404	313.6012	635.3394	805.9894	814.0692	804.8475	(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	1952.0680	1902.4328	1699.4350	1400.1475	1000.9689	577.6773	300.9057	314.9459	686.9716	1151.5706	1581.7655	1933.1552	(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	822.2811	655.5452	526.6028	273.6059	91.4738	0.0000	0.0000	0.0000	0.0000	257.1124	552.7414	839.4609	(98)
Space heating												4018.8235	(98)
Space heating per m2												31.1633	(99)
											(98) / (4) =		

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY FOR IMPROVED DWELLING 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													4440.6889	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	822.2811	655.5452	526.6028	273.6059	91.4738	0.0000	0.0000	0.0000	0.0000	257.1124	552.7414	839.4609	(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)	908.5979	724.3593	581.8815	302.3269	101.0761	0.0000	0.0000	0.0000	0.0000	284.1021	610.7639	927.5811	(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	182.0018	159.5737	165.6005	145.6940	140.7695	122.9045	115.3094	130.3014	131.2588	151.2113	163.3554	176.6931	(64)	
Efficiency of water heater (217)m	89.9028	89.8552	89.7133	89.3618	88.5330	87.3000	87.3000	87.3000	87.3000	89.2880	89.7495	89.9268	(216)	
Fuel for water heating, kWh/month	202.4429	177.5898	184.5886	163.0383	159.0023	140.7841	132.0841	149.2571	150.3538	169.3524	182.0125	196.4854	(219)	
Water heating fuel used												2006.9914	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4440.6889	(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)													496.5096	(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													5195.0303	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	4440.6889	3.8700	171.8547 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	2006.9914	3.8700	77.6706 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	496.5096	18.9000	93.8403 (250)
Additional standing charges			93.0000 (251)
Energy saving/generation technologies			
PV Unit	-1824.1596	18.9000	-344.7662 (252)
Total energy cost			105.7744 (255)

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

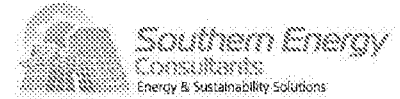
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4440.6889	0.2160	959.1888 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.9914	0.2160	433.5101 (264)
Space and water heating			1392.6989 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	496.5096	0.5190	257.6885 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	0.5190	-946.7389 (269)
Total kg/year			742.5736 (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	4440.6889	1.2200	5417.6405 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2006.9914	1.2200	2448.5295 (264)
Space and water heating			7866.1700 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	496.5096	3.0700	1524.2844 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			4020.5343 (272)
Primary energy kWh/m2/year			31.1766 (273)

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 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 East
Overshading	Average or unknown
Thermal mass parameter	185.3 (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	411.10 (P1)
Transmission heat loss coefficient	92.28 (37)
Summer heat loss coefficient	503.38 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	0.6000	98.8453	0.4400	0.0000	0.9000	23.4856
South East	8.1100	119.9223	0.4400	0.0000	0.9000	385.1378
North West	10.0700	98.8453	0.4400	0.0000	0.9000	394.1673
total:						802.7907

	Jun	Jul	Aug	
Solar gains	855	803	701	(P4)
Internal gains	543	520	530	
Total summer gains	1398	1323	1231	(P5)
Summer gain/loss ratio	2.78	2.63	2.45	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 185.3)	0.70	0.70	0.70	
Threshold temperature	19.48	21.23	20.95	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			