

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG009		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Sem Bri Ga Ea		
Property	WP2, Plot 63,64				
SAP Rating	84 B	DER	16.63	TSL	17.41
Environmental	36 B	% DER<TER	4.47		
CO ₂ Emissions (t/year)	1.40	DREE	47.14	TTEE	51.70
General Requirements Compliance	Pass	% DPEE<TTEE	8.82		
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

Semi-Detached House, total floor area 103 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 17.41 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.63 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.7 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.1 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.32 (max. 2.00)	1.40 (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:

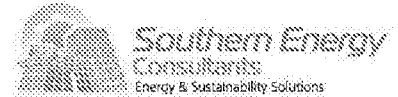
Overshading: Average
Windows facing North: 3.99 m², No overhang
Windows facing South: 7.35 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1068 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3568 (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) =	0.3032 (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	0.3866	0.3791	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3412	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (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)			11.3400	1.2357	14.0133		(27)
Heat Loss Floor 1			51.5600	0.1800	9.2808	75.0000	3867.0000 (28a)
Brick Cavity	110.6400	13.4900	97.1500	0.2500	24.2875	60.0000	5829.0000 (29a)
External Roof 1	51.5600		51.5600	0.1100	5.6716	9.0000	464.0400 (30)
Total net area of external elements Aum(A, m ²)			213.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2632		(33)
Party Wall 1			56.6800	0.0000	0.0000	110.0000	6234.8000 (32)
Internal Wall 1			171.6300			9.0000	1544.6700 (32c)
Internal Floor 1			51.5600			18.0000	928.0800 (32d)
Internal Ceiling 1			51.5600			18.0000	928.0800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 19795.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							191.9673 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9287 (36)
Total fabric heat loss							(33) + (36) = 65.1919 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.2965	53.0273	52.7635	51.5244	51.2926	50.2133	50.2133	50.0134	50.6290	51.2926	51.7616	52.2519 (38)
Heat transfer coeff	118.4884	118.2193	117.9555	116.7163	116.4845	115.4053	115.4053	115.2054	115.8210	116.4845	116.9535	117.4438 (39)
Average = Sum(39)m / 12 =												116.7152 (39)
HLP	1.1490	1.1464	1.1439	1.1318	1.1296	1.1191	1.1191	1.1172	1.1232	1.1296	1.1341	1.1389 (40)
HLP (average)												1.1318 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
Daily hot water use	Jan 109.8972	Feb 105.9010	Mar 101.9047	Apr 97.9084	May 93.9122	Jun 89.9159	Jul 89.9159	Aug 93.9122	Sep 97.9084	Oct 101.9047	Nov 105.9010	Dec 109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)												Total = Sum(45)m = 1571.9192 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

**Southern Energy
Consultants**
Energy & Sustainability Solutions

	24.4462	21.3808	22.0630	19.2351	18.4565	15.9266	14.7583	16.9354	17.1376	19.9723	21.8013	23.6748 (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	14.1477	12.7674	14.1096	13.6141	14.0339	13.5419	13.9689	14.0110	13.5813	14.0761	13.6616	14.1354 (61)
Total heat required for water heating calculated for each month	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (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	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (64)
								Total per year (kWh/year) =	Sum(64)m =			1737.5681 (64)
Heat gains from water heating, kWh/month	57.7259	50.5859	52.4338	46.0413	44.4204	38.6894	36.2065	41.0429	41.3838	47.7909	51.7416	56.0130 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
((66)m	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3550	23.4083	19.0369	14.4122	10.7733	9.0952	9.8277	12.7744	17.1458	21.7706	25.4095	27.0875 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.2752	263.9865	257.1543	242.6094	224.2490	206.9929	195.4647	192.7535	199.5857	214.1306	232.4909	249.7471 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330 (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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637 (71)
Water heating gains (Table 5)	77.5886	75.2766	70.4755	63.9463	59.7049	53.7353	48.6646	55.1651	57.4775	64.2351	71.8634	75.2863 (72)
Total internal gains	432.7177	430.1702	414.1656	388.4667	362.2260	337.3223	321.4560	328.1920	341.7079	367.6351	397.2627	419.6197 (73)

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d			Gains W
North					3,9900	10.6334	0.4400	0.0000	0.7700			14.3743 (74)
South					7.3500	46.7521	0.4400	0.0000	0.7700			116.4211 (78)
Solar gains	130.7954	218.1378	289.5553	349.4811	387.0513	383.4091	369.9178	341.2962	309.8361	238.3526	155.7313	112.5817 (83)
Total gains	563.5131	648.3080	703.7208	737.9477	749.2773	720.7314	691.3738	669.4981	651.5440	605.9877	552.9939	532.2014 (84)

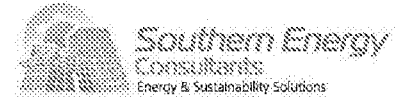
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	46.4079	46.5135	46.6176	47.1125	47.2063	47.6477	47.6477	47.7304	47.4767	47.2063	47.0169	46.8207
alpha	4.0939	4.1009	4.1078	4.1408	4.1471	4.1765	4.1765	4.1820	4.1651	4.1471	4.1345	4.1214
util living area	0.9958	0.9920	0.9845	0.9663	0.9214	0.8166	0.6671	0.7032	0.8789	0.9709	0.9923	0.9967 (86)
MIT	19.4184	19.5932	19.8634	20.2169	20.5597	20.8314	20.9477	20.9335	20.7458	20.3018	19.7945	19.3869 (87)
Th 2	19.9610	19.9631	19.9652	19.9749	19.9767	19.9852	19.9852	19.9868	19.9820	19.9767	19.9730	19.9692 (88)
util rest of house	0.9947	0.9899	0.9800	0.9554	0.8922	0.7429	0.5412	0.5830	0.8239	0.9594	0.9899	0.9958 (89)
MIT 2	17.8447	18.1008	18.4951	19.0110	19.4916	19.8437	19.9581	19.9491	19.7446	19.1383	18.4021	17.8040 (90)
Living area fraction									fLa = Living area / (4) =			0.2163 (91)
MIT	18.1850	18.4235	18.7910	19.2718	19.7226	20.0573	20.1721	20.1620	19.9611	19.3899	18.7032	18.1463 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0350	18.2735	18.6410	19.1218	19.5726	19.9073	20.0221	20.0120	19.8111	19.2399	18.5532	17.9963 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9915	0.9846	0.9718	0.9430	0.8776	0.7362	0.5462	0.5864	0.8124	0.9476	0.9847	0.9931 (94)
Useful gains	558.6976	638.3186	683.8643	695.8793	657.5528	530.6061	377.6404	392.5621	529.3394	574.2418	544.5299	528.5552 (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	1627.4376	1581.0075	1432.0946	1193.0521	917.0349	612.4865	394.9241	416.1210	661.4666	1006.4140	1339.4968	1620.2919 (97)
Month fractl	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	795.1425	633.4869	556.6833	357.9644	193.0547	0.0000	0.0000	0.0000	0.0000	321.5361	572.3762	812.2521 (98)
Space heating												4242.4964 (98)
Space heating per m2												(98) / (4) = 41.1414 (99)

Not applicable

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													4687.8413 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	795.1425	633.4869	556.6833	357.9644	193.0547	0.0000	0.0000	0.0000	0.0000	321.5361	572.3762	812.2521	(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)	878.6105	699.9856	615.1197	395.5407	213.3201	0.0000	0.0000	0.0000	0.0000	355.2886	632.4599	897.5162	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	177.1221	155.3058	161.1965	141.8461	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674	(64)
Efficiency of water heater (217)m	89.8997	89.8515	89.7612	89.5682	89.1432	87.3000	87.3000	87.3000	87.3000	89.4700	89.7845	87.3000	(216)
Fuel for water heating, kWh/month	197.0219	172.8471	179.5837	158.3687	153.7721	137.1353	128.7029	145.3764	146.4287	164.5520	177.0947	191.2362	(219)
Water heating fuel used												1952.1197	(219)
Annual totals kWh/year													
Space heating fuel - main system												4687.8413	(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)												465.4378	(232)
Total delivered energy for all uses												7180.3987	(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	4687.8413	0.2160	1012.5737 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1952.1197	0.2160	421.6579 (264)
Space and water heating			1434.2316 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.4378	0.5190	241.5622 (268)
Total CO2, kg/year			1714.7188 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.6300 (273)

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

DER		16.6300	ZC1
Total Floor Area	TFA	103.1200	
Assumed number of occupants	N	2.7666	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.0142	ZC2
CO2 emissions from cooking, equation (L16)		1.7979	ZC3
Total CO2 emissions		33.4421	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.4421	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	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (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) = 0.1423 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3923 (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) =				0.3335 (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	0.4252	0.4169	0.4085	0.3668	0.3585	0.3168	0.3168	0.3085	0.3335	0.3585	0.3752	0.3919 (22b)
Effective ac	0.5904	0.5869	0.5834	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			11.3400	1.3258	15.0341		(27)					
Heat Loss Floor 1			51.5600	0.1300	6.7028		(28a)					
Brick Cavity	110.6400	13.4900	97.1500	0.1800	17.4870		(29a)					
External Roof 1	51.5600		51.5600	0.1300	6.7028		(30)					
Total net area of external elements Aum(A, m2)			213.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)			(26)... (30) + (32) =		48.0767		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2179 (36)					
Total fabric heat loss						(33) + (36) =	58.2946 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.7482	Feb 54.4227	Mar 54.1036	Apr 52.6050	May 52.3246	Jun 51.0193	Jul 51.0193	Aug 50.7775	Sep 51.5220	Oct 52.3246	Nov 52.8918	Dec 53.4848 (38)
Heat transfer coeff	113.0428	112.7173	112.3982	110.8996	110.6192	109.3139	109.3139	109.0721	109.8166	110.6192	111.1864	111.7794 (39)
Average = Sum(39)m / 12 =												110.8982 (39)
HLP	Jan 1.0962	Feb 1.0931	Mar 1.0900	Apr 1.0754	May 1.0727	Jun 1.0601	Jul 1.0601	Aug 1.0577	Sep 1.0649	Oct 1.0727	Nov 1.0782	Dec 1.0840 (40)
HLP (average)												1.0754 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.8972	105.9010	101.9047	97.9084	93.9122	89.9159	89.9159	93.9122	97.9084	101.9047	105.9010	109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)											Total = Sum(45)m =	1571.9192 (45)
Distribution loss (46)m = 0.15 x (45)m												
	24.4462	21.3808	22.0630	19.2351	18.4565	15.9266	14.7583	16.9354	17.1376	19.9723	21.8013	23.6748 (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												

Regs Region: England

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Combi loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Total heat required for water heating calculated for each month	50.9589	46.0274	50.9589	48.2836	47.8566	44.3421	45.8202	47.8566	48.2836	50.9589	49.3151	50.9589 (61)
Solar input	213.9333	188.5658	198.0458	176.5175	170.9001	150.5193	144.2089	160.7592	162.5346	184.1074	194.6571	208.7909 (62)
Output from w/h	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Heat gains from water heating, kWh/month	213.9333	188.5658	198.0458	176.5175	170.9001	150.5193	144.2089	160.7592	162.5346	184.1074	194.6571	208.7909 (64)
	66.9287	58.9009	61.6461	54.7087	52.8761	46.3894	44.1693	49.5043	50.0594	57.0116	60.6550	65.2189 (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	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3550	23.4083	19.0369	14.4122	10.7733	9.0952	9.8277	12.7744	17.1458	21.7706	25.4095	27.0875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.2752	263.9865	257.1543	242.6094	224.2490	206.9929	195.4647	192.7535	199.5857	214.1306	232.4909	249.7471	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	(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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	(71)
Water heating gains (Table 5)	89.9579	87.6501	82.8577	75.9843	71.0701	64.4298	59.3674	66.5380	69.5269	76.6285	84.2430	87.6598	(72)
Total internal gains	445.0871	442.5437	426.5477	400.5047	373.5912	348.0168	332.1587	339.5648	353.7573	380.0286	409.6423	431.9932	(73)

6. Solar gains

[Jan]													
	Area m2				Solar flux Table 6a W/m2		Specific data or Table 6b		Specific data or Table 6c		Access factor Table 6d		Gains W
North	3.9900				10.6334		0.6300		0.7000		0.7700		12.9663
South	7.3500				46.7521		0.6300		0.7000		0.7700		105.0171 (74)
Solar gains	117.9834	196.7702	261.1920	315.2478	349.1378	345.8524	333.6827	307.8647	279.4863	215.0049	140.4767	101.5538	(83)
Total gains	563.0705	639.3140	687.7397	715.7525	722.7290	693.8692	665.8414	647.4295	633.2435	595.0334	550.1190	533.5470	(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	63.3487	63.5316	63.7120	64.5729	64.7366	65.5096	65.5096	65.6548	65.2097	64.7366	64.4064	64.0647	
alpha	5.2232	5.2354	5.2475	5.3049	5.3158	5.3673	5.3673	5.3770	5.3473	5.3158	5.2938	5.2710	
util living area	0.9987	0.9972	0.9937	0.9830	0.9490	0.8464	0.6823	0.7198	0.9075	0.9853	0.9973	0.9991	(86)
MIT	19.7809	19.9166	20.1286	20.4107	20.6832	20.8960	20.9753	20.9669	20.8306	20.4788	20.0801	19.7603	(87)
Th 2	20.0039	20.0065	20.0090	20.0209	20.0232	20.0336	20.0336	20.0355	20.0296	20.0232	20.0187	20.0139	(88)
util rest of house	0.9983	0.9963	0.9914	0.9758	0.9242	0.7709	0.5521	0.5947	0.8540	0.9776	0.9962	0.9987	(89)
MIT 2	18.3697	18.5699	18.8808	19.2976	19.6812	19.9535	20.0231	20.0199	19.8800	19.3999	18.8179	18.3468	(90)
Living area fraction	18.6749	18.8611	19.1506	19.5383	19.8979	20.1573	20.2290	20.2247	20.0856	19.6332	19.0909	18.6524	(91)
MIT	18.6749	18.8611	19.1506	19.5383	19.8979	20.1573	20.2290	20.2247	20.0856	19.6332	19.0909	18.6524	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6749	18.8611	19.1506	19.5383	19.8979	20.1573	20.2290	20.2247	20.0856	19.6332	19.0909	18.6524	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9974	0.9947	0.9885	0.9710	0.9202	0.7820	0.5803	0.6214	0.8577	0.9733	0.9946	0.9980	(94)
Ext temp.	561.6176	635.9036	679.8015	694.9966	665.0565	542.6162	386.3648	402.3033	543.1547	579.1298	547.1277	532.5060	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1624.9795	1573.6600	1421.9049	1179.7880	906.8445	607.4882	396.6990	417.1673	657.3150	999.2439	1333.2228	1615.4857	(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	791.1412	630.1724	552.1249	349.0498	179.8903	0.0000	0.0000	0.0000	0.0000	312.5649	565.9885	805.7369	(98)
Space heating per m2												4186.6689	(98)
												40.6000	(99)

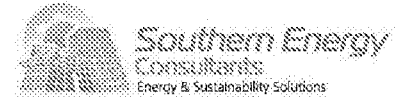
8c. Space cooling requirement

Not applicable

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

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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													4482.5149 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	791.1412	630.1724	552.1249	349.0498	179.8903	0.0000	0.0000	0.0000	0.0000	312.5649	565.9885	805.7369	(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)	847.0463	674.7027	591.1402	373.7150	192.6020	0.0000	0.0000	0.0000	0.0000	334.6519	605.9834	862.6733	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	213.9333	188.5658	198.0458	176.5175	170.9001	150.5193	144.2089	160.7592	162.5346	184.1074	194.6571	208.7909	(64)
Efficiency of water heater	88.0429	87.8550	87.4947	86.7359	85.1804	80.3000	80.3000	80.3000	80.3000	86.3730	87.5809	88.1190	(216)
(217)m													(217)
Fuel for water heating, kWh/month	242.9876	214.6331	226.3518	203.5115	200.6332	187.4462	179.5877	200.1982	202.4092	213.1540	222.2596	236.9419	(219)
Water heating fuel used												2530.1140	(219)
Annual totals kWh/year													
Space heating fuel - main system												4482.5149	(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)												465.4378	(232)
Total delivered energy for all uses												7553.0666	(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	4482.5149	0.2160	968.2232 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2530.1140	0.2160	546.5046 (264)
Space and water heating			1514.7278 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.4378	0.5190	241.5622 (268)
Total CO2, kg/m2/year			1795.2150 (272)
Emissions per m2 for space and water heating			14.6890 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3425 (272b)
Emissions per m2 for pumps and fans			0.3775 (272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6890 * 1.00) + 2.3425 + 0.3775, rounded to 2 d.p.			17.4100 (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	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (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) = 0.1423 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3923 (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) =				0.3335 (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	0.4252	0.4169	0.4085	0.3668	0.3585	0.3168	0.3168	0.3085	0.3335	0.3585	0.3752	0.3919 (22b)
Effective ac	0.5904	0.5869	0.5834	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768 (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)			11.3400	1.2357	14.0133		(27)
Heat Loss Floor 1			51.5600	0.1800	9.2808	75.0000	3867.0000 (28a)
Brick Cavity	110.6400	13.4900	97.1500	0.2500	24.2875	60.0000	5829.0000 (29a)
External Roof 1	51.5600		51.5600	0.1100	5.6716	9.0000	464.0400 (30)
Total net area of external elements Aum(A, m ²)			213.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2632		(33)
Party Wall 1			56.6800	0.0000	0.0000	110.0000	6234.8000 (32)
Internal Wall 1			171.6300			9.0000	1544.6700 (32c)
Internal Floor 1			51.5600			18.0000	928.0800 (32d)
Internal Ceiling 1			51.5600			9.0000	464.0400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19331.6300 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							187.4673 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9287 (36)
Total fabric heat loss						(33) + (36) =	65.1919 (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	54.7482	54.4227	54.1036	52.6050	52.3246	51.0193	51.0193	50.7775	51.5220	52.3246	52.6918	53.4848 (38)
Heat transfer coeff	119.9402	119.6147	119.2956	117.7969	117.5165	116.2112	116.2112	115.9695	116.7140	117.5165	118.0838	118.6768 (39)
Average = Sum(39)m / 12 =												117.7956 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1631	1.1600	1.1569	1.1423	1.1396	1.1270	1.1270	1.1246	1.1318	1.1396	1.1451	1.1509 (40)
HLP (average)												1.1423 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.8972	105.9010	101.9047	97.9084	93.9122	89.9159	89.9159	93.9122	97.9084	101.9047	105.9010	109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)												Total = Sum(45)m = 1571.9192 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems

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System) version 4.14r16

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CALCULATION OF 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 (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)
Primary loss	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	34.6321	30.2894	31.2560	27.2497	26.1467	22.5627	20.9076	23.9918	24.2783	28.2941	30.8852	33.5393 (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	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3550	23.4083	19.0369	14.4122	10.7733	9.0952	9.8277	12.7744	17.1458	21.7706	25.4095	27.0875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.2752	263.9865	257.1543	242.6094	224.2490	206.9929	195.4647	192.7535	199.5857	214.1306	232.4909	249.7471	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	(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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	(71)
Water heating gains (Table 5)	46.5485	45.0735	42.0107	37.8468	35.1435	31.3370	28.1016	32.2470	33.7199	38.0296	42.8961	45.0797	(72)
Total internal gains	398.6776	396.9672	382.7008	359.3672	334.6646	311.9240	297.8930	302.2739	314.9503	338.4297	365.2954	386.4132	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9900	10.6334	0.4400	0.0000	0.7700	14.3743 (74)
South	7.3500	46.7521	0.4400	0.0000	0.7700	116.4211 (78)

Solar gains	130.7954	218.1378	289.5553	349.4811	397.0513	383.4091	369.9178	341.2962	309.8361	238.3526	155.7313	112.5817	(83)
Total gains	529.4730	615.1050	672.2560	708.8483	721.7159	695.3331	667.8108	643.5700	624.7864	576.7823	521.0266	498.9948	(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	44.7715	44.8933	45.0134	45.5861	45.6948	46.2081	46.2081	46.3044	46.0090	45.6948	45.4753	45.2481	
alpha	3.9848	3.9929	4.0009	4.0391	4.0463	4.0805	4.0805	4.0870	4.0673	4.0463	4.0317	4.0165	
util living area	0.9963	0.9928	0.9859	0.9692	0.9277	0.8292	0.6844	0.7218	0.8897	0.9741	0.9933	0.9971	(86)
MIT	19.3300	19.5104	19.7906	20.1603	20.5183	20.8092	20.9380	20.9213	20.7156	20.2486	19.7228	19.3018	(87)
Th 2	19.9496	19.9522	19.9547	19.9664	19.9686	19.9789	19.9789	19.9808	19.9749	19.9686	19.9642	19.9595	(88)
util rest of house	0.9954	0.9909	0.9819	0.9592	0.9006	0.7582	0.5582	0.6024	0.8381	0.9638	0.9912	0.9964	(89)
MIT 2	18.4216	18.6032	18.8836	19.2571	19.6025	19.8672	19.9562	19.9493	19.7902	19.3484	18.8247	18.4010	(90)
Living area fraction									fLA = Living area / (4) =				0.2163 (91)
MIT	18.6181	18.7994	19.0797	19.4525	19.8006	20.0709	20.1685	20.1595	19.9903	19.5431	19.0189	18.5958	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6181	18.7994	19.0797	19.4525	19.8006	20.0709	20.1685	20.1595	19.9903	19.5431	19.0189	18.5958	(93)

8. Space heating requirement

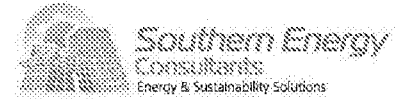
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9936	0.9880	0.9774	0.9528	0.8952	0.7657	0.5840	0.6258	0.8390	0.9582	0.9885	0.9949	(94)
Useful gains	526.0943	607.7413	657.0487	675.3589	646.0805	532.3945	390.0162	402.7742	524.2268	552.6522	515.0141	496.4706	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1717.3101	1662.5746	1500.7039	1243.0480	951.9516	635.7832	414.7041	435.9902	687.4838	1050.9580	1407.4299	1708.4504	(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	886.2646	708.8480	627.6795	408.7361	227.5681	0.0000	0.0000	0.0000	0.0000	370.7395	642.5394	901.7129	(98)
Space heating												4774.0882	(98)
Space heating per m2											(98) / (4) =	46.2964	(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	1092.3854	859.9630	881.3682	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7293	0.8152	0.7937	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	796.7176	701.0177	699.5172	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	920.8582	886.4788	860.4905	0.0000	0.0000	0.0000	0.0000	(103)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014											
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	89.3812	137.9831	119.7642	0.0000	0.0000	0.0000 (104)
Space cooling											347.1284 (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 (106)
Space cooling kWh											
	0.0000	0.0000	0.0000	0.0000	0.0000	22.3453	34.4958	29.9410	0.0000	0.0000	0.0000 (107)
Space cooling											86.7821 (107)
Space cooling per m2											0.8416 (108)
Energy for space heating											46.2964 (99)
Energy for space cooling											0.8416 (108)
Total											47.1380 (109)
Dwelling Fabric Energy Efficiency (DFEE)											47.1 (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	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (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) = 0.1423 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3923 (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) =	0.3335 (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	0.4252	0.4169	0.4085	0.3668	0.3585	0.3168	0.3168	0.3085	0.3335	0.3585	0.3752	0.3919 (22b)
Effective ac	0.5904	0.5869	0.5834	0.5673	0.5643	0.5502	0.5502	0.5476	0.5556	0.5643	0.5704	0.5768 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Opening Type (Uw = 1.40)			11.3400	1.3258	15.0341		(27)					
Heat Loss Floor 1			51.5600	0.1300	6.7028		(28a)					
Brick Cavity	110.6400	13.4900	97.1500	0.1800	17.4870		(29a)					
External Roof 1	51.5600		51.5600	0.1300	6.7028		(30)					
Total net area of external elements Aum(A, m2)			213.7600				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)... (30) + (32) =	48.0767		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							10.2179 (36)					
Total fabric heat loss						(33) + (36) =	58.2946 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 54.7482	Feb 54.4227	Mar 54.1036	Apr 52.6050	May 52.3246	Jun 51.0193	Jul 51.0193	Aug 50.7775	Sep 51.5220	Oct 52.3246	Nov 52.8918	Dec 53.4848 (38)
Heat transfer coeff	113.0428	112.7173	112.3982	110.8996	110.6192	109.3139	109.3139	109.0721	109.8166	110.6192	111.1864	111.7794 (39)
Average = Sum(39)m / 12 =												110.8982 (39)
HLP	Jan 1.0962	Feb 1.0931	Mar 1.0900	Apr 1.0754	May 1.0727	Jun 1.0601	Jul 1.0601	Aug 1.0577	Sep 1.0649	Oct 1.0727	Nov 1.0782	Dec 1.0840 (40)
HLP (average)												1.0754 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
Daily hot water use	Jan 109.8972	Feb 105.9010	Mar 101.9047	Apr 97.9084	May 93.9122	Jun 89.9159	Jul 89.9159	Aug 93.9122	Sep 97.9084	Oct 101.9047	Nov 105.9010	Dec 109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)										Total = Sum(45)m =		1571.9192 (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												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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 (57)
Heat gains from water heating, kWh/month	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)
	34.6321	30.2894	31.2560	27.2497	26.1467	22.5627	20.9076	23.9918	24.2783	28.2941	30.8852	33.5393 (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	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	138.3296	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	26.3550	23.4083	19.0369	14.4122	10.7733	9.0952	9.8277	12.7744	17.1458	21.7706	25.4095	27.0875	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	261.2752	263.9865	257.1543	242.6094	224.2490	206.9929	195.4647	192.7535	199.5857	214.1306	232.4909	249.7471	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	36.8330	(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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	(71)
Water heating gains (Table 5)	46.5485	45.0735	42.0107	37.8468	35.1435	31.3370	28.1016	32.2470	33.7199	38.0296	42.8961	45.0797	(72)
Total internal gains	398.6776	396.9672	382.7008	359.3672	334.6646	311.9240	297.8930	302.2739	314.9503	338.4297	365.2954	386.4132	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9900	10.6334	0.6300	0.7000	0.7700	12.9663 (74)
South	7.3500	46.7521	0.6300	0.7000	0.7700	105.0171 (78)

Solar gains	117.9834	196.7702	261.1920	315.2478	349.1378	345.8524	333.6827	307.8647	279.4863	215.0049	140.4767	101.5538	(83)
Total gains	516.6610	593.7374	643.8928	674.6150	683.8025	657.7764	631.5756	610.1385	594.4366	553.4346	505.7721	487.9669	(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	63.3487	63.5316	63.7120	64.5729	64.7366	65.5096	65.5096	65.6548	65.2097	64.7366	64.4064	64.0647	
alpha	5.2232	5.2354	5.2475	5.3049	5.3158	5.3673	5.3673	5.3770	5.3473	5.3158	5.2938	5.2710	
util living area	0.9992	0.9981	0.9954	0.9869	0.9586	0.8677	0.7104	0.7507	0.9251	0.9893	0.9982	0.9994	(86)
MIT	19.7385	19.8753	20.0894	20.3757	20.6552	20.8807	20.9701	20.9595	20.8077	20.4430	20.0397	19.7184	(87)
Th 2	20.0039	20.0065	20.0090	20.0209	20.0232	20.0336	20.0336	20.0355	20.0296	20.0232	20.0187	20.0139	(88)
util rest of house	0.9989	0.9974	0.9936	0.9811	0.9375	0.7970	0.5790	0.6259	0.8782	0.9835	0.9974	0.9992	(89)
MIT 2	18.8458	18.9844	19.2000	19.4934	19.7649	19.9690	20.0246	20.0220	19.9101	19.5631	19.1587	18.8339	(90)
Living area fraction									fLA = Living area / (4) =			0.2163	(91)
MIT	19.0389	19.1771	19.3923	19.6842	19.9574	20.1662	20.2291	20.2247	20.1042	19.7534	19.3492	19.0252	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0389	19.1771	19.3923	19.6842	19.9574	20.1662	20.2291	20.2247	20.1042	19.7534	19.3492	19.0252	(93)

8. Space heating requirement

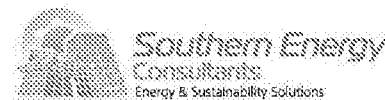
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9985	0.9966	0.9921	0.9785	0.9357	0.8083	0.6078	0.6530	0.8827	0.9813	0.9967	0.9989	(94)
Ext temp.	515.8735	591.7079	638.7901	660.1184	639.8585	531.7046	383.8858	398.4289	524.6877	543.0909	504.0901	487.4195	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Month fracti	1666.1225	1609.2741	1449.0743	1195.9598	913.4279	608.4594	396.7094	417.1704	659.3637	1012.5375	1361.9443	1657.1508	(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	855.7853	683.8046	602.8515	385.8058	203.5356	0.0000	0.0000	0.0000	0.0000	349.2683	617.6550	870.2801	(98)
Space heating per m2												4568.9861	(98)
										(98) / (4) =		44.3075	(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	1027.5503	808.9226	828.9483	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7694	0.8603	0.8393	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	790.5612	695.9417	695.7460	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	876.9608	844.1260	821.4148	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	62.2077	110.2491	93.4976	0.0000	0.0000	0.0000	0.0000	(104)
Space cooling												265.9544	(104)
Cooled fraction									fC = cooled area / (4) =			1.0000	(105)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

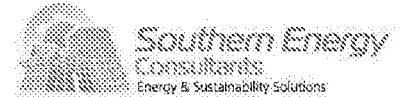


CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	15.5519	27.5623	23.3744	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												66.4886	(107)
Space cooling per m2												0.6448	(108)
Energy for space heating												44.3075	(99)
Energy for space cooling												0.6448	(108)
Total												44.9522	(109)
Target Fabric Energy Efficiency (TFEE)												51.7	(109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1068 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3568 (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) =	0.3032 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3184	0.3032	0.3032	0.2805	0.2805	0.2502	0.2578	0.2426	0.2502	0.2653	0.2653	0.2881 (22b)
	0.5507	0.5460	0.5460	0.5393	0.5393	0.5313	0.5332	0.5294	0.5313	0.5352	0.5352	0.5415 (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)			11.3400	1.2357	14.0133		(27)
Heat Loss Floor 1			51.5600	0.1800	9.2808	75.0000	3867.0000 (28a)
Brick Cavity	110.6400	13.4900	97.1500	0.2500	24.2875	60.0000	5829.0000 (29a)
External Roof 1	51.5600		51.5600	0.1100	5.6716	9.0000	464.0400 (30)
Total net area of external elements Aum(A, m ²)			213.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2632		(33)
Party Wall 1			56.6800	0.0000	0.0000	110.0000	6234.8000 (32)
Internal Wall 1			171.6300			9.0000	1544.6700 (32c)
Internal Floor 1			51.5600			18.0000	928.0800 (32d)
Internal Ceiling 1			51.5600			18.0000	928.0800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 19795.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							191.9673 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9287 (36)
Total fabric heat loss						(33) + (36) =	65.1919 (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	51.0660	50.6290	50.6290	50.0134	50.0134	49.2673	49.4458	49.0941	49.2673	49.6297	49.6297	50.2133 (38)
Heat transfer coeff	116.2580	115.8210	115.8210	115.2054	115.2054	114.4593	114.6378	114.2860	114.4593	114.8217	114.8217	115.4053 (39)
Average = Sum(39)m / 12 =												115.1001 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1274	1.1232	1.1232	1.1172	1.1172	1.1100	1.1117	1.1083	1.1100	1.1135	1.1135	1.1191 (40)
HLP (average)												1.1162 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.8972	105.9010	101.9047	97.9084	93.9122	89.9159	89.9159	93.9122	97.9084	101.9047	105.9010	109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)												Total = Sum(45)m = 1571.9192 (45)
Distribution loss (46)m = 0.15 x (45)m												

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

	24.4462	21.3808	22.0630	19.2351	18.4565	15.9266	14.7583	16.9354	17.1376	19.9723	21.6013	23.6748 (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	14.1477	12.7674	14.1096	13.6141	14.0339	13.5419	13.9689	14.0110	13.5813	14.0761	13.6616	14.1354 (61)
Total heat required for water heating calculated for each month	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (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	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	57.7259	50.5859	52.4338	46.0413	44.4204	38.6894	36.2065	41.0429	41.3838	47.7909	51.7416	56.0130 (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	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.8875	58.5207	47.5922	36.0304	26.9331	22.7381	24.5693	31.9361	42.8646	54.4264	63.5237	67.7187 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.9630	394.0096	383.8123	362.1035	334.7000	308.9446	291.7384	287.6918	297.8891	319.5979	347.0014	372.7568 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661 (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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637 (71)
Water heating gains (Table 5)	77.5886	75.2766	70.4755	63.9463	59.7049	53.7353	48.6646	55.1651	57.4775	64.2351	71.8634	75.2863 (72)
Total internal gains	646.1371	640.5049	614.5781	574.7782	534.0360	498.1160	477.6703	487.4910	510.9291	550.9574	595.0865	628.4598 (73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
North					3.9900	11.9814	0.4400		0.0000		0.7700		16.1967
South					7.3500	50.9848	0.4400		0.0000		0.7700		126.9614 (78)

Solar gains	143.1580	214.7047	282.0748	353.2096	383.8975	408.3670	389.1602	364.9123	327.8754	250.5505	174.5683	122.0807	(83)
Total gains	789.2952	855.2097	896.6529	927.9877	917.9336	906.4829	866.8306	852.4033	838.8045	801.5079	769.6548	750.5406	(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	47.2982	47.4767	47.4767	47.7304	47.7304	48.0415	47.9667	48.1143	48.0415	47.8899	47.8899	47.6477
alpha	4.1532	4.1651	4.1651	4.1820	4.1820	4.2028	4.1978	4.2076	4.2028	4.1927	4.1927	4.1765
util living area	0.9831	0.9751	0.9564	0.9114	0.8086	0.5943	0.4042	0.4220	0.7037	0.9061	0.9689	0.9857 (86)
MIT	19.7976	19.9342	20.1947	20.5135	20.7985	20.9622	20.9944	20.9932	20.9172	20.6029	20.1599	19.7700 (87)
Th 2	19.9785	19.9820	19.9820	19.9868	19.9868	19.9927	19.9913	19.9941	19.9927	19.9898	19.9898	19.9852 (88)
util rest of house	0.9787	0.9687	0.9446	0.8858	0.7507	0.4897	0.2757	0.2930	0.6113	0.8737	0.9595	0.9820 (89)
MIT 2	18.4067	18.6058	18.9789	19.4271	19.7962	19.9711	19.9900	19.9924	19.9337	19.5565	18.9386	18.3718 (90)
Living area fraction	18.7075	18.8931	19.2419	19.6620	20.0129	20.1854	20.2072	20.2088	20.1464	19.7828	19.2027	18.6742 (92)
Temperature adjustment	18.5575	18.7431	19.0919	19.5120	19.8629	20.0354	20.0572	20.0588	19.9964	19.6328	19.0527	-0.1500
adjusted MIT												18.5242 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9702	0.9582	0.9311	0.8710	0.7426	0.4944	0.2842	0.3015	0.6117	0.8595	0.9478	0.9744 (94)
Ext temp.	765.7910	819.4477	834.9105	808.2969	681.6131	448.1600	246.3809	256.9673	513.0971	688.9300	729.4506	731.3343 (95)
Heat loss rate W	5.1000	5.6000	7.4000	9.9000	13.0000	16.0000	17.9000	17.8000	15.2000	11.6000	8.0000	5.1000 (96)
Month fracti	1564.5415	1522.2480	1354.1620	1107.3586	790.6436	461.8908	247.2958	258.1511	548.9911	922.3418	1269.0950	1549.2191 (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	594.2704	472.2818	386.3231	215.3244	81.1187	0.0000	0.0000	0.0000	0.0000	173.6584	388.5440	608.5063 (98)
RHI space heating demand												2920.0271 (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	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
								Air changes per hour				
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1068 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3568 (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) =	0.3032 (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	0.3866	0.3791	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3412	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (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)			11.3400	1.2357	14.0133		(27)
Heat Loss Floor 1			51.5600	0.1800	9.2808	75.0000	3867.0000 (28a)
Brick Cavity	110.6400	13.4900	97.1500	0.2500	24.2875	60.0000	5829.0000 (29a)
External Roof 1	51.5600		51.5600	0.1100	5.6716	9.0000	464.0400 (30)
Total net area of external elements Aum(A, m ²)			213.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2632		(33)
Party Wall 1			56.6800	0.0000	0.0000	110.0000	6234.8000 (32)
Internal Wall 1			171.6300			9.0000	1544.6700 (32c)
Internal Floor 1			51.5600			18.0000	928.0800 (32d)
Internal Ceiling 1			51.5600			18.0000	928.0800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19795.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							191.9673 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9287 (36)
Total fabric heat loss						(33) + (36) =	65.1919 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.2965	53.0273	52.7635	51.5244	51.2926	50.2133	50.2133	50.0134	50.6290	51.2926	51.7616	52.2519 (38)
Heat transfer coeff	118.4884	118.2193	117.9555	116.7163	116.4845	115.4053	115.4053	115.2054	115.8210	116.4845	116.9535	117.4438 (39)
Average = Sum(39)m / 12 =												116.7152 (39)
HLP	1.1490	1.1464	1.1439	1.1318	1.1296	1.1191	1.1191	1.1172	1.1232	1.1296	1.1341	1.1389 (40)
HLP (average)												1.1318 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
Daily hot water use	Jan 109.8972	Feb 105.9010	Mar 101.9047	Apr 97.9084	May 93.9122	Jun 89.9159	Jul 89.9159	Aug 93.9122	Sep 97.9084	Oct 101.9047	Nov 105.9010	Dec 109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)												Total = Sum(45)m = 1571.9192 (45)
Distribution loss (46)m = 0.15 x (45)m												

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

	24.4462	21.3808	22.0630	19.2351	18.4565	15.9266	14.7583	16.9354	17.1376	19.9723	21.6013	23.6748 (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	14.1477	12.7674	14.1096	13.6141	14.0339	13.5419	13.9689	14.0110	13.5813	14.0761	13.6616	14.1354 (61)
Total heat required for water heating calculated for each month	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (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	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (64)
Heat gains from water heating, kWh/month	57.7259	50.5859	52.4338	46.0413	44.4204	38.6894	36.2065	41.0429	41.3838	47.7909	51.7416	56.0130 (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	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.8875	58.5207	47.5922	36.0304	26.9331	22.7381	24.5693	31.9361	42.8646	54.4264	63.5237	67.7187	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.9630	394.0096	383.8123	362.1035	334.7000	308.9446	291.7384	287.6918	297.8891	319.5979	347.0014	372.7568	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	(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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	(71)
Water heating gains (Table 5)	77.5886	75.2766	70.4755	63.9463	59.7049	53.7353	48.6646	55.1651	57.4775	64.2351	71.8634	75.2863	(72)
Total internal gains	646.1371	640.5049	614.5781	574.7782	534.0360	498.1160	477.6703	487.4910	510.9291	550.9574	595.0865	628.4598	(73)

6. Solar gains

[Jan]					Area m ²	Solar flux Table 6a W/m ²	g Specific data or Table 6b	FF Specific data or Table 6c				Access factor Table 6d	Gains W	
North					3.9900	10.6334	0.4400	0.0000				0.7700	14.3743 (74)	
South					7.3500	46.7521	0.4400	0.0000				0.7700	116.4211 (78)	
Solar gains	130.7954	218.1378	289.5553	349.4811	387.0513	383.4091	369.9178	341.2962	309.8361	238.3526	155.7313	112.5817 (83)		
Total gains	776.9325	858.6427	904.1333	924.2592	921.0873	881.5250	847.5881	828.7872	820.7652	789.3100	750.8177	741.0415 (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	46.4079	46.5135	46.6176	47.1125	47.2063	47.6477	47.6477	47.7304	47.4767	47.2063	47.0169	46.8207	
alpha	4.0939	4.1009	4.1078	4.1408	4.1471	4.1765	4.1765	4.1820	4.1651	4.1471	4.1345	4.1214	
util living area	0.9867	0.9787	0.9643	0.9327	0.8650	0.7297	0.5687	0.6000	0.7955	0.9337	0.9775	0.9889	(86)
MIT	19.6476	19.8133	20.0634	20.3837	20.6789	20.8929	20.9711	20.9633	20.8359	20.4684	20.0018	19.6132	(87)
Th 2	19.9610	19.9631	19.9652	19.9749	19.9767	19.9852	19.9852	19.9868	19.9820	19.9767	19.9730	19.9692	(88)
util rest of house	0.9833	0.9733	0.9549	0.9135	0.8237	0.6472	0.4510	0.4846	0.7249	0.9112	0.9709	0.9861	(89)
MIT 2	18.1771	18.4180	18.7792	19.2396	19.6395	19.9015	19.9713	19.9677	19.8402	19.3645	18.6999	18.1328	(90)
Living area fraction	18.4951	18.7198	19.0569	19.4870	19.8643	20.1159	20.1875	20.1830	20.0555	19.6032	18.9814	18.4530	(91)
MIT	18.3451	18.5698	18.9069	19.3370	19.7143	19.9659	20.0375	20.0330	19.9055	19.4532	18.8314	18.3030	(92)
Temperature adjustment													
adjusted MIT	18.3451	18.5698	18.9069	19.3370	19.7143	19.9659	20.0375	20.0330	19.9055	19.4532	18.8314	18.3030	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	758.2272	827.3078	851.8747	830.5025	747.0828	569.0223	387.6748	406.2892	590.0041	707.5682	721.3736	725.9136	(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	1664.1857	1616.0291	1463.4633	1218.1680	933.5427	619.2491	396.7096	418.5441	672.4018	1031.2661	1372.0317	1656.3063	(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	674.0331	530.0207	455.0220	279.1192	138.7262	0.0000	0.0000	0.0000	0.0000	240.8313	468.4738	692.2122	(98)
Space heating													
Space heating per m2													

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 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 %)												90.5000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												3843.5785 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	674.0331	530.0207	455.0220	279.1192	138.7262	0.0000	0.0000	0.0000	0.0000	240.8313	468.4738	692.2122 (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)	744.7880	585.6582	502.7867	308.4190	153.2886	0.0000	0.0000	0.0000	0.0000	266.1119	517.6507	764.8754 (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	177.1221	155.3058	161.1965	141.8461	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (64)
Efficiency of water heater (217)m	89.8149	89.7544	89.6405	89.3958	88.8808	87.3000	87.3000	87.3000	87.3000	89.2587	89.6671	87.3000 (216)
Fuel for water heating, kWh/month	197.2079	173.0341	179.8256	158.6741	154.2262	137.1353	128.7029	145.3764	146.4287	164.9415	177.3265	191.4052 (219)
Water heating fuel used												1954.2844 (219)
Annual totals kWh/year												
Space heating fuel - main system												3843.5785 (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)												465.4378 (232)
Total delivered energy for all uses												6338.3006 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3843.5785	3.4800	133.7565 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1954.2844	3.4800	68.0091 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	465.4378	13.1900	61.3912 (250)
Additional standing charges			120.0000 (251)
Total energy cost			393.0494 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.1145 (257)
SAP value		84.4526
SAP rating (Section 12)		84 (258)
SAP band		B

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

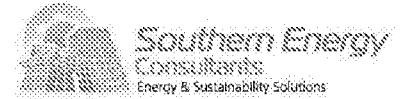
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3843.5785	0.2160	830.2130 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1954.2844	0.2160	422.1254 (264)
Space and water heating			1252.3384 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.4378	0.5190	241.5622 (268)
Total kg/year			1532.8256 (272)
CO2 emissions per m2			14.8600 (273)
EI value			86.1330
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	$3.48 / 0.8879 = 3.919$, stars = 4
Water heating environmental impact	$0.216 / 0.8879 = 0.2433$, stars = 4

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	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1068 (8)				
Pressure test							Yes					
Measured/design AP50								5.0000				
Infiltration rate								0.3568 (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) =	0.3032 (21)				
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 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	0.3184	0.3032	0.3032	0.2805	0.2805	0.2502	0.2578	0.2426	0.2502	0.2653	0.2653	0.2881 (22b)
Effective ac	0.5507	0.5460	0.5460	0.5393	0.5393	0.5313	0.5332	0.5294	0.5313	0.5352	0.5352	0.5415 (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)			11.3400	1.2357	14.0133		(27)
Heat Loss Floor 1			51.5600	0.1800	9.2808	75.0000	3867.0000 (28a)
Brick Cavity	110.6400	13.4900	97.1500	0.2500	24.2875	60.0000	5829.0000 (29a)
External Roof 1	51.5600		51.5600	0.1100	5.6716	9.0000	464.0400 (30)
Total net area of external elements Aum(A, m ²)			213.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2632		(33)
Party Wall 1			56.6800	0.0000	0.0000	110.0000	6234.8000 (32)
Internal Wall 1			171.6300			9.0000	1544.6700 (32c)
Internal Floor 1			51.5600			18.0000	928.0800 (32d)
Internal Ceiling 1			51.5600			18.0000	928.0800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19795.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							191.9673 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9287 (36)
Total fabric heat loss						(33) + (36) =	65.1919 (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	51.0660	50.6290	50.6290	50.0134	50.0134	49.2673	49.4458	49.0941	49.2673	49.6297	49.6297	50.2133 (38)
Heat transfer coeff	116.2580	115.8210	115.8210	115.2054	115.2054	114.4593	114.6378	114.2860	114.4593	114.8217	114.8217	115.4053 (39)
Average = Sum(39)m / 12 =												115.1001 (39)
HLP	1.1274	1.1232	1.1232	1.1172	1.1172	1.1100	1.1117	1.1083	1.1100	1.1135	1.1135	1.1191 (40)
HLP (average)												1.1162 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
Daily hot water use	Jan 109.8972	Feb 105.9010	Mar 101.9047	Apr 97.9084	May 93.9122	Jun 89.9159	Jul 89.9159	Aug 93.9122	Sep 97.9084	Oct 101.9047	Nov 105.9010	Dec 109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)												Total = Sum(45)m = 1571.9192 (45)
Distribution loss (46)m = 0.15 x (45)m												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

Southern Energy Consultants
Energy & Sustainability Solutions

	24.4462	21.3808	22.0630	19.2351	18.4565	15.9266	14.7583	16.9354	17.1376	19.9723	21.8013	23.6748 (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	14.1477	12.7674	14.1096	13.6141	14.0339	13.5419	13.9689	14.0110	13.5813	14.0761	13.6616	14.1354 (61)
Total heat required for water heating calculated for each month	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (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	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (64)
								Total per year (kWh/year) =	Sum(64)m =			1737.5681 (64)
Heat gains from water heating, kWh/month	57.7259	50.5859	52.4338	46.0413	44.4204	38.6894	36.2065	41.0429	41.3838	47.7909	51.7416	56.0130 (65)

Metabolic gains (Table 5), Watts												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.8875	58.5207	47.5922	36.0304	26.9331	22.7381	24.5693	31.9361	42.8646	54.4264	63.5237	67.7187 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	389.9630	394.0096	383.8123	362.1035	334.7000	308.9446	291.7384	287.6918	297.8891	319.5979	347.0014	372.7568 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661 (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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637 (71)
Water heating gains (Table 5)	77.5886	75.2766	70.4755	63.9463	59.7049	53.7353	48.6646	55.1651	57.4775	64.2351	71.8634	75.2863 (72)
Total internal gains	646.1371	640.5049	614.5781	574.7782	534.0360	498.1160	477.6703	487.4910	510.9291	550.9574	595.0865	628.4598 (73)

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9900	11.9814	0.4400	0.0000	0.7700	16.1967 (74)
South	7.3500	50.9848	0.4400	0.0000	0.7700	126.9614 (78)

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	47.2982	47.4767	47.4767	47.7304	47.7304	48.0415	47.9667	48.1143	48.0415	47.8899	47.8899	47.6477
alpha	4.1532	4.1651	4.1651	4.1820	4.1820	4.2028	4.1978	4.2076	4.2028	4.1927	4.1927	4.1765
util living area	0.9831	0.9751	0.9564	0.9114	0.8086	0.5943	0.4042	0.4220	0.7037	0.9061	0.9689	0.9857 (86)
MIT	19.7976	19.9342	20.1947	20.5135	20.7985	20.9622	20.9944	20.9932	20.9172	20.6029	20.1599	19.7700 (87)
Th 2	19.9785	19.9820	19.9820	19.9868	19.9868	19.9927	19.9913	19.9941	19.9927	19.9898	19.9898	19.9852 (88)
util rest of house	0.9787	0.9687	0.9446	0.8858	0.7507	0.4897	0.2757	0.2930	0.6113	0.8737	0.9595	0.9820 (89)
MIT 2	18.4067	18.6058	18.9789	19.4271	19.7962	19.9711	19.9900	19.9924	19.9337	19.5565	18.9386	18.3718 (90)
Living area fraction	18.7075	18.8931	19.2419	19.6620	20.0129	20.1854	20.2742	20.2088	20.1464	19.7828	19.2027	0.2163 (91)
MIT	18.7075	18.8931	19.2419	19.6620	20.0129	20.1854	20.2742	20.2088	20.1464	19.7828	19.2027	18.6742 (92)
Temperature adjustment	18.7075	18.8931	19.2419	19.6620	20.0129	20.1854	20.2742	20.2088	20.1464	19.7828	19.2027	-0.1500
adjusted MIT	18.5575	18.7431	19.0919	19.5120	19.8629	20.0354	20.0572	20.0588	19.9964	19.6328	19.0527	18.5242 (93)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9702	0.9582	0.9311	0.8710	0.7426	0.4944	0.2842	0.3015	0.6117	0.8595	0.9478	0.9744 (94)
Useful gains	765.7910	819.4477	834.9105	808.2969	681.6131	448.1600	246.3809	256.9673	513.0971	688.9300	729.4506	731.3343 (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	1564.5415	1522.2480	1354.1620	1107.3586	790.6436	461.8908	247.2958	258.1511	548.9911	922.3418	1269.0950	1549.2191 (97)
Month fractl	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	594.2704	472.2818	386.3231	215.3244	81.1187	0.0000	0.0000	0.0000	0.0000	173.6584	388.5440	608.5063 (98)
Space heating												2920.0271 (98)
Space heating per m2												28.3168 (99)
										(98) / (4) =		

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF EPC COSTS, EMISSIONS AND PRIMARY ENERGY 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 %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3226.5493 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	594.2704	472.2818	386.3231	215.3244	81.1187	0.0000	0.0000	0.0000	0.0000	173.6584	388.5440	608.5063	(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)	656.6524	521.8583	426.8764	237.9275	89.6340	0.0000	0.0000	0.0000	0.0000	191.8877	429.3304	672.3827	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	177.1221	155.3058	161.1965	141.8461	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674	(64)
Efficiency of water heater (217)m	89.7447	89.6865	89.5338	89.2015	88.4629	87.3000	87.3000	87.3000	87.3000	89.0032	89.5468	87.3000	(216)
Fuel for water heating, kWh/month	197.3623	173.1653	180.0399	159.0199	154.9547	137.1353	128.7029	145.3764	146.4287	165.4150	177.5648	191.5539	(219)
Water heating fuel used												1956.7190	(219)
Annual totals kWh/year													
Space heating fuel - main system													3226.5493 (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)													465.4378 (232)
Total delivered energy for all uses													5723.7060 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3226.5493	3.8700	124.8675 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1956.7190	3.8700	75.7250 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	465.4378	18.9000	87.9677 (250)
Additional standing charges			93.0000 (251)
Total energy cost			395.7352 (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	3226.5493	0.2160	696.9347 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1956.7190	0.2160	422.6513 (264)
Space and water heating			1119.5859 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	465.4378	0.5190	241.5622 (268)
Total kg/year			1400.0731 (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	3226.5493	1.2200	3936.3902 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1956.7190	1.2200	2387.1971 (264)
Space and water heating			6323.5873 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	465.4378	3.0700	1428.8939 (268)
Primary energy kWh/year			7982.7312 (272)
Primary energy kWh/m2/year			77.4121 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 84
Current environmental impact rating: B 86

(For testing purposes):

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E	Low energy lighting
F	Already installed
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N	Solar water heating
O	Recommended
P	Not considered
R	Not considered
S	Not considered
T	Not considered
U	Solar photovoltaic panels
A2	Recommended
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
L2	Not applicable
Q3	Not considered
O3	Not considered

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.1	-£ 29	-190 kg (13.6%)
U Solar photovoltaic panels	+ 9.0	-£ 345	-947 kg (78.3%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£29	1.84 kg/m²	B 86	B 88
Solar photovoltaic panels	£345	9.18 kg/m²	A 95	A 96
Total Savings	£374	11.03 kg/m²		

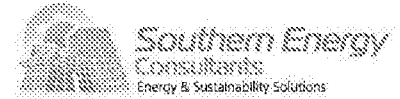
Potential energy efficiency rating: A 95
 Potential environmental impact rating: A 96

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

Typical heating and lighting costs of this home (per year, Thames Valley):			
	Current	Potential	Saving
Electricity	£102	£112	-£9
Mains gas	£294	£255	£39
Space heating	£232	£232	£0
Water heating	£76	£46	£29
Lighting	£88	£88	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£396	£22	£375
Total cost of uses	£396	£21	£374
Delivered energy	56 kWh/m²	29 kWh/m²	27 kWh/m²
Carbon dioxide emissions	1.4 tonnes	0.3 tonnes	1.1 tonnes
CO2 emissions per m²	14 kg/m²	3 kg/m²	11 kg/m²
Primary energy	77 kWh/m²	13 kWh/m²	65 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	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1068 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3568 (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) =				0.3032 (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	0.3866	0.3791	0.3715	0.3336	0.3260	0.2881	0.2881	0.2805	0.3032	0.3260	0.3412	0.3563 (22b)
Effective ac	0.5747	0.5718	0.5690	0.5556	0.5531	0.5415	0.5415	0.5393	0.5460	0.5531	0.5582	0.5635 (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)			11.3400	1.2357	14.0133		(27)
Heat Loss Floor 1			51.5600	0.1800	9.2808	75.0000	3867.0000 (28a)
Brick Cavity	110.6400	13.4900	97.1500	0.2500	24.2875	60.0000	5829.0000 (29a)
External Roof 1	51.5600		51.5600	0.1100	5.6716	9.0000	464.0400 (30)
Total net area of external elements Aum(A, m ²)			213.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2632		(33)
Party Wall 1			56.6800	0.0000	0.0000	110.0000	6234.8000 (32)
Internal Wall 1			171.6300			9.0000	1544.6700 (32c)
Internal Floor 1			51.5600			18.0000	928.0800 (32d)
Internal Ceiling 1			51.5600			18.0000	928.0800 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	19795.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							191.9673 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9287 (36)
Total fabric heat loss						(33) + (36) =	65.1919 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	53.2965	53.0273	52.7635	51.5244	51.2926	50.2133	50.2133	50.0134	50.6290	51.2926	51.7616	52.2519 (38)
Heat transfer coeff	118.4884	118.2193	117.9555	116.7163	116.4845	115.4053	115.4053	115.2054	115.8210	116.4845	116.9535	117.4438 (39)
Average = Sum(39)m / 12 =												116.7152 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.1490	1.1464	1.1439	1.1318	1.1296	1.1191	1.1191	1.1172	1.1232	1.1296	1.1341	1.1389 (40)
HLP (average)												1.1318 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	109.8972	105.9010	101.9047	97.9084	93.9122	89.9159	89.9159	93.9122	97.9084	101.9047	105.9010	109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)												Total = Sum(45)m = 1571.9192 (45)
Distribution loss (46)m = 0.15 x (45)m												

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

	24.4462	21.3808	22.0630	19.2351	18.4565	15.9266	14.7583	16.9354	17.1376	19.9723	21.6013	23.6748 (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	14.1477	12.7674	14.1096	13.6141	14.0339	13.5419	13.9689	14.0110	13.5813	14.0761	13.6616	14.1354 (61)
Total heat required for water heating calculated for each month	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m ²												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1537 (H8)
Utilisation factor												0.5797 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.9066 (H14)
Volume ratio Veff/V												0.7507 (H15)
Solar storage volume factor												0.9427 (H16)
Solar input	-25.2687	-42.1662	-71.8139	-96.2447	-118.9022	-116.8999	-115.3550	-100.7862	-78.9358	-53.9039	-29.9723	-871.3944 (H17)
Output from w/h	151.8534	113.1396	89.3826	45.6033	18.1751	2.8193	0.0000	26.1274	48.8964	93.3207	129.0313	150.8218 (64)
Heat gains from water heating, kWh/month	57.7259	50.5859	52.4338	46.0413	44.4204	38.6894	36.2065	41.0429	41.3838	47.7909	51.7416	869.1710 (64)
												Sum(63)m = -871.3944 (63)
												Sum(64)m = 869.1710 (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	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.8875	58.5207	47.5922	36.0304	26.9331	22.7381	24.5693	31.9361	42.8646	54.4264	63.5237	67.7187	(67)
Appliances gains (calculated in Appendix L13 or L13a), also see Table 5	389.9630	394.0096	383.8123	362.1035	334.7000	308.9446	291.7384	287.6918	297.8891	319.5979	347.0014	372.7568	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	(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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	(71)
Water heating gains (Table 5)	77.5886	75.2766	70.4755	63.9463	59.7049	53.7353	48.6646	55.1651	57.4775	64.2351	71.8634	75.2863	(72)
Total internal gains	646.1371	640.5049	614.5781	574.7782	534.0360	498.1160	477.6703	487.4910	510.9291	550.9574	595.0865	628.4598	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c			Access factor Table 6d			Gains W	
North					3.9900	10.6334	0.4400		0.0000			0.7700			14.3743 (74)
South					7.3500	46.7521	0.4400		0.0000			0.7700			116.4211 (78)

Solar gains	130.7954	218.1378	289.5553	349.4811	387.0513	383.4091	369.9178	341.2962	309.8361	238.3526	155.7313			112.5817 (83)	
Total gains	776.9325	858.6427	904.1333	924.2592	921.0873	881.5250	847.5881	828.7872	820.7652	789.3100	750.8177			741.0415 (84)	

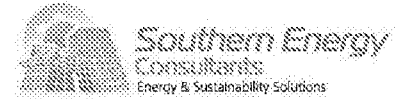
7. Mean internal temperature (heating season)

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	46.4079	46.5135	46.6176	47.1125	47.2063	47.6477	47.6477	47.7304	47.4767	47.2063	47.0169	46.8207	
alpha	4.0939	4.1009	4.1078	4.1408	4.1471	4.1765	4.1765	4.1820	4.1651	4.1471	4.1345	4.1214	
util living area	0.9867	0.9787	0.9643	0.9327	0.8650	0.7297	0.5687	0.6000	0.7955	0.9337	0.9775	0.9889	(86)
MIT	19.6476	19.8133	20.0634	20.3837	20.6789	20.8929	20.9711	20.9633	20.8359	20.4684	20.0018	19.6132	(87)
Th 2	19.9610	19.9631	19.9652	19.9749	19.9767	19.9852	19.9852	19.9868	19.9820	19.9767	19.9730	19.9692	(88)
util rest of house	0.9833	0.9733	0.9549	0.9135	0.8237	0.6472	0.4510	0.4846	0.7249	0.9112	0.9709	0.9861	(89)
MIT 2	18.1771	18.4180	18.7792	19.2396	19.6395	19.9015	19.9713	19.9677	19.8402	19.3645	18.6999	18.1328	(90)
Living area fraction									fLA = Living area / (4) =			0.2163	(91)
MIT	18.4951	18.7198	19.0569	19.4870	19.8643	20.1159	20.1875	20.1830	20.0555	19.6032	18.9814	18.4530	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3451	18.5698	18.9069	19.3370	19.7143	19.9659	20.0375	20.0330	19.9055	19.4532	18.8314	18.3030	(93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9759	0.9635	0.9422	0.8986	0.8111	0.6455	0.4574	0.4902	0.7188	0.8964	0.9608	0.9796	(94)
Useful gains	758.2272	827.3078	851.8747	830.5025	747.0828	569.0223	387.6748	406.2892	590.0041	707.5682	721.3736	725.9136	(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	1664.1857	1616.0291	1463.4633	1218.1680	933.5427	619.2491	396.7096	418.5441	672.4018	1031.2661	1372.0317	1656.3063	(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	674.0331	530.0207	455.0220	279.1192	138.7262	0.0000	0.0000	0.0000	0.0000	240.8313	468.4738	692.2122	(98)
Space heating												3478.4385	(98)
Space heating per m2											(98) / (4) =	33.7319	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3843.5785 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	674.0331	530.0207	455.0220	279.1192	138.7262	0.0000	0.0000	0.0000	0.0000	240.8313	468.4738	692.2122	(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)	744.7880	585.6582	502.7867	308.4190	153.2886	0.0000	0.0000	0.0000	0.0000	266.1119	517.6507	764.8754	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	151.8534	113.1396	89.3826	45.6033	18.1751	2.8193	0.0000	26.1274	48.8964	93.3207	129.0313	150.8218	(64)
Efficiency of water heater	89.8941	89.9202	89.9586	90.0365	90.1174	87.3000	87.3000	87.3000	87.3000	89.5829	89.7893	89.9104	(216)
Fuel for water heating, kWh/month	166.9247	125.8223	99.3597	50.6498	20.1683	3.2294	0.0000	29.9283	56.0096	104.1724	143.7046	167.7468	(219)
Water heating fuel used												969.7159	(219)
Annual totals kWh/year													
Space heating fuel - main system												3843.5785	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													465.4378 (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												3676.4928	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3843.5785	3.4800	133.7565	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	969.7159	3.4800	33.7461	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	465.4378	13.1900	61.3912	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			137.5585	(255)

11a. SAP rating - Individual heating systems

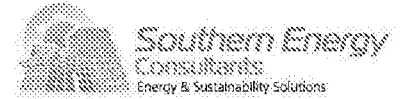
Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.3901 (257)
SAP value			94.5588
SAP rating (Section 12)			95 (258)
SAP band			A

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	3843.5785	0.2160	830.2130	(261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

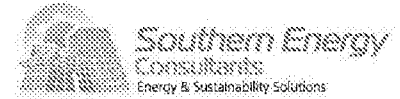


CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	969.7159	0.2160	209.4586 (264)
Space and water heating			1039.6716 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	465.4378	0.5190	241.5622 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			449.6715 (272)
CO2 emissions per m2			4.3600 (273)
EI value			95.9319
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	51.5600 (1b)	x 2.5900 (2b)	= 133.5404 (1b) - (3b)
First floor	51.5600 (1c)	x 2.8600 (2c)	= 147.4616 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	103.1200		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 281.0020 (5)

2. Ventilation rate

	main heating	+	secondary heating	+	other	=	total	m3 per hour				
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000 (6a)				
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000 (6b)				
Number of intermittent fans							3 * 10 =	30.0000 (7a)				
Number of passive vents							0 * 10 =	0.0000 (7b)				
Number of flueless gas fires							0 * 40 =	0.0000 (7c)				
Air changes per hour												
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =						30.0000 / (5) =	0.1068 (8)				
Pressure test							Yes					
Measured/design AP50							5.0000					
Infiltration rate							0.3568	(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) =	0.3032 (21)				
Wind speed	Jan 4.2000	Feb 4.0000	Mar 4.0000	Apr 3.7000	May 3.7000	Jun 3.3000	Jul 3.4000	Aug 3.2000	Sep 3.3000	Oct 3.5000	Nov 3.5000	Dec 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	0.3184	0.3032	0.3032	0.2805	0.2805	0.2502	0.2578	0.2426	0.2502	0.2653	0.2653	0.2881 (22b)
Effective ac	0.5507	0.5460	0.5460	0.5393	0.5393	0.5313	0.5332	0.5294	0.5313	0.5352	0.5352	0.5415 (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)			11.3400	1.2357	14.0133		(27)
Heat Loss Floor 1			51.5600	0.1800	9.2808	75.0000	3867.0000 (28a)
Brick Cavity	110.6400	13.4900	97.1500	0.2500	24.2875	60.0000	5829.0000 (29a)
External Roof 1	51.5600		51.5600	0.1100	5.6716	9.0000	464.0400 (30)
Total net area of external elements Aum(A, m ²)			213.7600				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2632		(33)
Party Wall 1			56.6800	0.0000	0.0000	110.0000	6234.8000 (32)
Internal Wall 1			171.6300			9.0000	1544.6700 (32c)
Internal Floor 1			51.5600			18.0000	928.0800 (32d)
Internal Ceiling 1			51.5600			18.0000	928.0800 (32e)
Heat capacity Cm = Sum(A x k)							(28)...(30) + (32) + (32a)...(32e) = 19795.6700 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							191.9673 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9287 (36)
Total fabric heat loss							(33) + (36) = 65.1919 (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	51.0660	50.6290	50.6290	50.0134	50.0134	49.2673	49.4458	49.0941	49.2673	49.6297	49.6297	50.2133 (38)
Heat transfer coeff	116.2580	115.8210	115.8210	115.2054	115.2054	114.4593	114.6378	114.2860	114.4593	114.8217	114.8217	115.4053 (39)
Average = Sum(39)m / 12 =												115.1001 (39)
HLP	1.1274	1.1232	1.1232	1.1172	1.1172	1.1100	1.1117	1.1083	1.1100	1.1135	1.1135	1.1191 (40)
HLP (average)												1.1162 (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												2.7666 (42)
Average daily hot water use (litres/day)												99.9066 (43)
Daily hot water use	Jan 109.8972	Feb 105.9010	Mar 101.9047	Apr 97.9084	May 93.9122	Jun 89.9159	Jul 89.9159	Aug 93.9122	Sep 97.9084	Oct 101.9047	Nov 105.9010	Dec 109.8972 (44)
Energy conte	162.9744	142.5384	147.0869	128.2339	123.0435	106.1772	98.3888	112.9026	114.2510	133.1485	145.3420	157.8320 (45)
Energy content (annual)												Total = Sum(45)m = 1571.9192 (45)
Distribution loss (46)m = 0.15 x (45)m												

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

	24.4462	21.3808	22.0630	19.2351	18.4565	15.9266	14.7583	16.9354	17.1376	19.9723	21.6013	23.6748 (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	14.1477	12.7674	14.1096	13.6141	14.0339	13.5419	13.9689	14.0110	13.5813	14.0761	13.6616	14.1354 (61)
Total heat required for water heating calculated for each month	177.1221	155.3058	161.1965	141.8481	137.0774	119.7191	112.3577	126.9136	127.8322	147.2246	159.0036	171.9674 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m ²												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2185 (H8)
Utilisation factor												0.5599 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												99.9066 (H14)
Volume ratio Veff/V												0.7507 (H15)
Solar storage volume factor												0.9427 (H16)
Solar input	-27.3581	-41.1192	-69.2500	-95.7247	-115.2847	-121.3321	-118.4187	-105.7486	-82.5372	-56.1485	-33.2545	-888.8426 (H17)
Output from w/h	149.7640	114.1866	91.9465	46.1234	21.7927	0.0000	0.0000	21.1650	45.2951	91.0761	125.7491	149.3010 (64)
Heat gains from water heating, kWh/month	57.7259	50.5859	52.4338	46.0413	44.4204	38.6894	36.2065	41.0429	41.3838	47.7909	51.7416	56.0130 (65)
Solar input (sum of months) = Sum(63)m = -888.8426 (63)												
Total per year (kWh/year) = Sum(64)m = 856.3995 (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	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955	165.9955 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	65.8875	58.5207	47.5922	36.0304	26.9331	22.7381	24.5693	31.9361	42.8646	54.4264	63.5237	67.7187 (67)
Appliances gains (calculated in Appendix L13 or L13a), also see Table 5	389.9630	394.0096	383.8123	362.1035	334.7000	308.9446	291.7384	287.6918	297.8891	319.5979	347.0014	372.7568 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661	54.3661 (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)	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637	-110.6637 (71)
Water heating gains (Table 5)	77.5886	75.2766	70.4755	63.9463	59.7049	53.7353	48.6646	55.1651	57.4775	64.2351	71.8634	75.2863 (72)
Total internal gains	646.1371	640.5049	614.5781	574.7782	534.0360	498.1160	477.6703	487.4910	510.9291	550.9574	595.0865	628.4598 (73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d	Gains W	
North				3.9900	11.9814	0.4400		0.0000		0.7700	16.1967 (74)	
South				7.3500	50.9848	0.4400		0.0000		0.7700	126.9614 (78)	

Solar gains	143.1580	214.7047	282.0748	353.2096	383.8975	408.3670	389.1602	364.9123	327.8754	250.5505	174.5683	122.0807 (83)
Total gains	789.2952	855.2097	896.6529	927.9877	917.9336	906.4829	866.8306	852.4033	838.8045	801.5079	769.6548	750.5406 (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	47.2982	47.4767	47.4767	47.7304	47.7304	48.0415	47.9667	48.1143	48.0415	47.8899	47.8899	47.6477
alpha	4.1532	4.1651	4.1651	4.1820	4.1820	4.2028	4.1978	4.2076	4.2028	4.1927	4.1927	4.1765
util living area	0.9831	0.9751	0.9564	0.9114	0.8086	0.5943	0.4042	0.4220	0.7037	0.9061	0.9689	0.9857 (86)
MIT	19.7976	19.9342	20.1947	20.5135	20.7985	20.9622	20.9944	20.9932	20.9172	20.6029	20.1599	19.7700 (87)
Th 2	19.9785	19.9820	19.9820	19.9868	19.9868	19.9927	19.9913	19.9941	19.9927	19.9898	19.9898	19.9852 (88)
util rest of house	0.9787	0.9687	0.9446	0.8858	0.7507	0.4897	0.2757	0.2930	0.6113	0.8737	0.9595	0.9820 (89)
MIT 2	18.4067	18.6058	18.9789	19.4271	19.7962	19.9711	19.9900	19.9924	19.9337	19.5565	18.9386	18.3718 (90)
Living area fraction									fLA = Living area / (4) =			0.2163 (91)
MIT	18.7075	18.8931	19.2419	19.6620	20.0129	20.1854	20.2072	20.2088	20.1464	19.7828	19.2027	18.6742 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5575	18.7431	19.0919	19.5120	19.8629	20.0354	20.0572	20.0588	19.9964	19.6328	19.0527	18.5242 (93)

8. Space heating requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9702	0.9582	0.9311	0.8710	0.7426	0.4944	0.2842	0.3015	0.6117	0.8595	0.9478	0.9744	(94)
Useful gains	765.7910	819.4477	834.9105	808.2969	681.6131	448.1600	246.3809	256.9673	513.0971	688.9300	729.4506	731.3343	(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	1564.5415	1522.2480	1354.1620	1107.3586	790.6436	461.8908	247.2958	258.1511	548.9911	922.3418	1269.0950	1549.2191	(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	594.2704	472.2818	386.3231	215.3244	81.1187	0.0000	0.0000	0.0000	0.0000	173.6584	388.5440	608.5063	(98)
Space heating												2920.0271	(98)
Space heating per m2											(98) / (4) =	28.3168	(99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3226.5493 (211)
Space heating requirement	594.2704	472.2818	386.3231	215.3244	81.1187	0.0000	0.0000	0.0000	0.0000	173.6584	388.5440	608.5063	(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)	656.6524	521.8583	426.8764	237.9275	89.6340	0.0000	0.0000	0.0000	0.0000	191.8877	429.3304	672.3827	(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	149.7640	114.1866	91.9465	46.1234	21.7927	0.0000	0.0000	21.1650	45.2951	91.0761	125.7491	149.3010	(64)
Efficiency of water heater	89.8372	89.8587	89.8667	89.9185	89.8029	87.3000	87.3000	87.3000	87.3000	89.3730	89.6961	89.8511	(217)
Fuel for water heating, kWh/month	166.7060	127.0735	102.3143	51.2946	24.2673	0.0000	0.0000	24.2440	51.8844	101.9057	140.1946	166.1648	(219)
Water heating fuel used												956.0493	(219)
Annual totals kWh/year													
Space heating fuel - main system												3226.5493	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump													30.0000 (230c)
main heating flue fan													45.0000 (230e)
pump for solar water heating													50.0000 (230g)
Total electricity for the above, kWh/year													125.0000 (231)
Electricity for lighting (calculated in Appendix L)													465.4378 (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												2948.8767	(238)

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

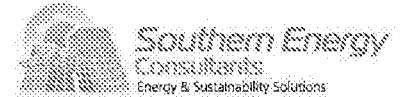
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3226.5493	3.8700	124.8675	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	956.0493	3.8700	36.9991	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	465.4378	18.9000	87.9677	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			21.6931	(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	3226.5493	0.2160	696.9347	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	956.0493	0.2160	206.5066	(264)
Space and water heating			903.4413	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	465.4378	0.5190	241.5622	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			263.1396	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

13a. Primary energy - Individual heating systems including micro-CHP

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year
Space heating - main system 1	3226.5493	1.2200	3936.3902 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	956.0493	1.2200	1166.3801 (264)
Space and water heating			5102.7703 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	465.4378	3.0700	1428.8939 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1315.2441 (272)
Primary energy kWh/m2/year			12.7545 (273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	North
Overshading	Average or unknown
Thermal mass parameter	192.0 (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	370.92 (P1)
Transmission heat loss coefficient	65.19 (37)
Summer heat loss coefficient	436.11 (P2)

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

Solar shading Orientation	Z blinds	Solar access	Z overhangs	Z summer
North	1.000	0.90	1.000	0.900 (P8)
South	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	3.9900	81.1852	0.4400	0.0000	0.9000	128.2758
South	7.3500	112.2060	0.4400	0.0000	0.9000	326.5868
total:						454.8626

	Jun	Jul	Aug	
Solar gains	477	455	427	(P4)
Internal gains	495	475	484	
Total summer gains	972	930	911	(P5)
Summer gain/loss ratio	2.23	2.13	2.09	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 192.0)	0.66	0.66	0.66	
Threshold temperature	18.89	20.69	20.55	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			