

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG005		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Det Cl Ea Ga		
Property	Lockwood Corner, Plot 54				
SAP Rating	84 B	DER	17.93	TET	18.47
Environmental	85 B	% DER<TER	2.90		
CO ₂ Emissions (t/year)	1.35	DPEE	51.39	TPEE	56.04
General Requirements Compliance	Pass	% DPEE<TPEE	8.29		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey			Assessor ID	T555-0001
Client	Persimon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Detached House, total floor area 91 m²

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

1a TER and DER

Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 18.47 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.93 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)56.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)51.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.24 (max. 0.30)	0.24 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.20 (max. 0.25)	0.20 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.34 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

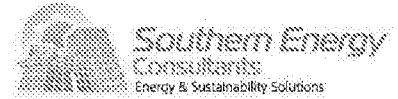
Overshading: Average
Windows facing North: 3.93 m², No overhang
Windows facing East: 0.48 m², No overhang
Windows facing South: 5.16 m², No overhang
Windows facing West: 6.97 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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				4 * 10 =	40.0000 (7a)
Number of passive vents				0 * 10 =	0.0000 (7b)
Number of flueless gas fires				0 * 40 =	0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =				40.0000 / (5) =	0.1814 (8)
Pressure test				Yes	
Measured/design AP50				5.0000	
Infiltration rate					0.4314 (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) =		0.3667 (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												
Effective ac	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
	0.6093	0.6050	0.6009	0.5613	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Clad Cavity	132.7600	20.8400	111.9200	0.2400	26.8608	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8767		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 77.0845 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	121.4299	121.1211	120.8184	119.3965	119.1305	117.8921	117.8921	117.6628	118.3691	119.1305	119.6687	120.2313 (39)
Average = Sum(39)m / 12 =												119.3953 (39)
HLP	1.3323	1.3290	1.3256	1.3100	1.3071	1.2935	1.2935	1.2910	1.2988	1.3071	1.3130	1.3192 (40)
HLP (average)												1.3100 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	404.1151	401.9226	387.3199	363.7104	339.6213	316.5064	301.5563	307.8118	319.9986	343.8293	371.2058	391.8504 (73)

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9300	10.6334	0.4400	0.0000	0.7700	14.1582 (74)
East	0.4800	19.6403	0.4400	0.0000	0.7700	3.1940 (76)
South	5.1600	46.7521	0.4400	0.0000	0.7700	81.7323 (78)
West	6.9700	19.6403	0.4400	0.0000	0.7700	46.3792 (80)

Solar gains	145.4637	257.8892	376.1911	499.4832	585.7541	591.9715	566.4554	501.2305	419.1396	291.6545	176.1586	123.1938 (83)
Total gains	549.5788	659.8118	763.5110	863.1936	925.3754	908.4779	868.0117	809.0424	739.1382	635.4838	547.3644	515.0442 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.1401	40.2424	40.3433	40.8237	40.9149	41.3446	41.3446	41.4252	41.1780	40.9149	40.7309	40.5403
alpha	3.6760	3.6828	3.6896	3.7216	3.7277	3.7563	3.7563	3.7617	3.7452	3.7277	3.7154	3.7027
util living area	0.9940	0.9877	0.9731	0.9351	0.8530	0.7111	0.5595	0.6117	0.8268	0.9578	0.9891	0.9953 (86)
MIT	19.2070	19.4276	19.7773	20.2248	20.6124	20.8676	20.9597	20.9434	20.7493	20.2331	19.6366	19.1708 (87)
Th 2	19.8156	19.8182	19.8208	19.8330	19.8353	19.8459	19.8459	19.8479	19.8418	19.8353	19.8306	19.8258 (88)
util rest of house	0.9923	0.9843	0.9654	0.9153	0.8063	0.6197	0.4293	0.4821	0.7550	0.9410	0.9856	0.9940 (89)
MIT 2	17.4427	17.7652	18.2724	18.9153	19.4378	19.7468	19.8279	19.8199	19.6246	18.9403	18.0793	17.3964 (90)
Living area fraction									fLA = Living area / (4) =			0.1925 (91)
MIT	17.7823	18.0851	18.5620	19.1673	19.6639	19.9625	20.0457	20.0361	19.8411	19.1891	18.3790	17.7379 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.6323	17.9351	18.4120	19.0173	19.5139	19.8125	19.8957	19.8861	19.6911	19.0391	18.2290	17.5879 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9875	0.9762	0.9523	0.8973	0.7908	0.6167	0.4353	0.4868	0.7436	0.9249	0.9780	0.9899 (94)
Ext temp.	542.6934	644.0975	727.0775	774.5098	731.7930	560.2730	377.8244	393.8315	549.6441	587.7345	535.3343	509.8679 (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	1618.9367	1578.8250	1439.1919	1207.9698	930.8705	614.5073	388.5391	410.1851	661.8121	1005.3496	1331.7922	1609.6387 (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 per m ²	800.7250	628.1369	529.8131	312.0912	148.1137	0.0000	0.0000	0.0000	0.0000	310.7056	573.4497	818.2295 (98)
												4121.2647 (98)
											(98) / (4) =	45.2191 (99)

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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													4553.8836	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	800.7250	628.1369	529.8131	312.0912	148.1137	0.0000	0.0000	0.0000	0.0000	310.7056	573.4497	818.2295	(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)	884.7790	694.0739	585.4289	344.8522	163.6615	0.0000	0.0000	0.0000	0.0000	343.3211	633.6460	904.1210	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)	
Efficiency of water heater (217)m	89.9165	89.8615	89.7488	89.4942	88.9550	87.3000	87.3000	87.3000	87.3000	89.4652	89.8008	89.9405	(217)	
Fuel for water heating, kWh/month	191.5608	168.0811	174.6997	154.2021	149.9496	133.4888	125.3239	141.4982	142.5034	160.1029	172.2190	185.9496	(219)	
Water heating fuel used												1899.5792	(219)	
Annual totals kWh/year														
Space heating fuel - main system													4553.8836	(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)													387.2964	(232)
Total delivered energy for all uses													6915.7592	(238)

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

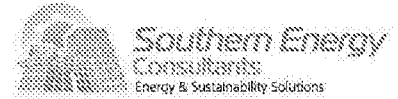
	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	4553.8836	0.2160	983.6389 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1899.5792	0.2160	410.3091 (264)
Space and water heating			1393.9480 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total CO2, kg/year			1633.8798 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.9300 (273)

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

DER		17.9300	ZC1
Total Floor Area	TFA	91.1400	
Assumed number of occupants	N	2.6410	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.6798	ZC2
CO2 emissions from cooking, equation (L16)		2.0011	ZC3
Total CO2 emissions		35.6110	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.6110	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	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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) =	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			16.5400	1.3258	21.9280		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Clad Cavity	132.7600	20.8400	111.9200	0.1800	20.1456		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)
Total net area of external elements Aum(A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6518		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1552 (36)
Total fabric heat loss						(33) + (36) =	69.8070 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7614	42.5140	42.2716	41.1330	40.9199	39.9282	39.9282	39.7445	40.3102	40.9199	41.3509	41.8015 (38)
Heat transfer coeff	112.5684	112.3211	112.0786	110.9400	110.7269	109.7352	109.7352	109.5515	110.1172	110.7269	111.1579	111.6085 (39)
Average = Sum(39)m / 12 =												110.9390 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2351	1.2324	1.2297	1.2172	1.2149	1.2040	1.2040	1.2020	1.2082	1.2149	1.2196	1.2246 (40)
HLP (average)												1.2172 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)
Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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)

Regs Region: England

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	50.9589	46.0274	50.3792	46.8421	46.4279	43.0183	44.4522	46.4279	46.8421	50.3792	49.3151	50.9589 (61)
Total heat required for water heating calculated for each month	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Output from w/h	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (64)
Heat gains from water heating, kWh/month	65.3109	57.4859	60.0411	53.0754	51.2975	45.0045	42.8506	48.0263	48.5648	55.5449	59.2122	63.6521 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4763	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	87.7835	85.5446	80.7004	73.7158	68.9483	62.5062	57.5949	64.5515	67.4512	74.6572	82.2392	85.5539 (72)
Total internal gains	416.4883	414.2999	399.5121	375.2541	350.5118	326.7459	311.8035	318.7096	331.5529	356.0323	383.5891	404.2277 (73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W
North	3.9300	10.6334	0.6300		0.7000	0.7700	12.7713 (74)
East	0.4800	19.6403	0.6300		0.7000	0.7700	2.8811 (76)
South	5.1600	46.7521	0.6300		0.7000	0.7700	73.7263 (78)
West	6.9700	19.6403	0.6300		0.7000	0.7700	41.8362 (80)

Solar gains	131.2149	232.6278	339.3415	450.5566	528.3768	533.9852	510.9685	452.1327	378.0830	263.0856	158.9031	111.1264 (83)
Total gains	547.7032	646.9277	738.8536	825.8106	878.8886	860.7311	822.7721	770.8423	709.6359	619.1180	542.4922	515.3541 (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	56.2251	56.3489	56.4708	57.0504	57.1601	57.6767	57.6767	57.7734	57.4766	57.1601	56.9385	56.7087
alpha	4.7483	4.7566	4.7647	4.8034	4.8107	4.8451	4.8451	4.8516	4.8318	4.8107	4.7959	4.7806
util living area	0.9980	0.9952	0.9871	0.9603	0.8864	0.7353	0.5677	0.6223	0.8555	0.9760	0.9957	0.9985 (86)
MIT	19.6471	19.8177	20.0901	20.4408	20.7446	20.9292	20.9839	20.9753	20.8443	20.4426	19.9774	19.6169 (87)
Th 2	19.8920	19.8942	19.8963	19.9062	19.9081	19.9168	19.9168	19.9184	19.9134	19.9081	19.9043	19.9004 (88)
util rest of house	0.9973	0.9935	0.9824	0.9448	0.8415	0.6408	0.4376	0.4912	0.7832	0.9637	0.9939	0.9980 (89)
MIT 2	18.0952	18.3456	18.7425	19.2490	19.6556	19.8692	19.9109	19.9082	19.7875	19.2607	18.5867	18.0570 (90)
Living area fraction									fLA = Living area / (4) =			0.1925 (91)
MIT	18.3939	18.6289	19.0018	19.4784	19.8652	20.0732	20.1174	20.1136	19.9909	19.4882	18.8543	18.3572 (92)
Temperature adjustment												0.0000
adjusted MIT	18.3939	18.6289	19.0018	19.4784	19.8652	20.0732	20.1174	20.1136	19.9909	19.4882	18.8543	18.3572 (93)

8. Space heating requirement

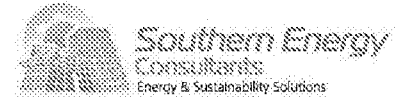
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9958	0.9906	0.9770	0.9370	0.8394	0.6558	0.4627	0.5163	0.7893	0.9572	0.9913	0.9968 (94)
Useful gains	545.4000	640.8577	721.8776	773.8049	737.7374	564.4405	380.6839	397.9691	560.1320	592.6254	537.7795	513.7126 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1586.5258	1542.0439	1401.1871	1173.5662	904.1039	600.6011	385.9824	406.8293	648.6849	984.1618	1306.5873	1580.0624 (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	774.5976	605.5972	505.4063	287.8281	123.7767	0.0000	0.0000	0.0000	0.0000	291.3030	553.5416	793.3643 (98)
Space heating												3935.4148 (98)
Space heating per m2										(98) / (4) =		43.1799 (99)

8c. Space cooling requirement

Not applicable

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												93.4000 (206)
Efficiency of secondary/supplementary heating system, %												0.0000 (208)
Space heating requirement												4213.5062 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	774.5976	605.5972	505.4063	287.8281	123.7767	0.0000	0.0000	0.0000	0.0000	291.3030	553.5416	793.3643 (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)	829.3336	648.3910	541.1203	308.1671	132.5232	0.0000	0.0000	0.0000	0.0000	311.8876	592.6570	849.4265 (211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (215)
Water heating requirement	209.0677	184.3104	193.0748	171.2476	165.7979	146.0256	139.9036	155.9597	157.6821	179.5525	190.3179	204.0789 (64)
Efficiency of water heater (217)m	88.0463	87.8226	87.3626	86.3486	84.3272	80.3000	80.3000	80.3000	80.3000	86.2626	87.5816	88.1320 (217)
Fuel for water heating, kWh/month	237.4521	209.8667	221.0040	198.3212	196.6127	181.8500	174.2262	194.2213	196.3663	208.1466	217.3036	231.5605 (219)
Water heating fuel used												2466.9313 (219)
Annual totals kWh/year												
Space heating fuel - main system												4213.5062 (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)												387.2964 (232)
Total delivered energy for all uses												7142.7339 (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	4213.5062	0.2160	910.1173 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2466.9313	0.2160	532.8572 (264)
Space and water heating			1442.9745 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total CO2, kg/m2/year			1682.9063 (272)
Emissions per m2 for space and water heating			15.8325 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.2055 (272b)
Emissions per m2 for pumps and fans			0.4271 (272c)
Target Carbon Dioxide Emission Rate (TER) = (15.8325 * 1.00) + 2.2055 + 0.4271, rounded to 2 d.p.			18.4700 (273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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)	=	0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Clad Cavity	132.7600	20.8400	111.9200	0.2400	26.8608	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8767		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			9.0000	410.1300 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17137.0200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 188.0296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 77.0845 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7614	42.5140	42.2716	41.1330	40.9199	39.9282	39.9282	39.7445	40.3102	40.9199	41.3509	41.8015 (38)
Heat transfer coeff	119.8459	119.5986	119.3562	118.2175	118.0045	117.0127	117.0127	116.8291	117.3947	118.0045	118.4354	118.8860 (39)
Average = Sum(39)m / 12 =												118.2165 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3150	1.3123	1.3096	1.2971	1.2948	1.2839	1.2839	1.2819	1.2881	1.2948	1.2995	1.3044 (40)
HLP (average)												1.2971 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.5981	29.3851	30.3228	26.4362	25.3661	21.8890	20.2834	23.2755	23.5535	27.4493	29.9631	32.5380 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	45.1588	43.7279	40.7565	36.7169	34.0943	30.4015	27.2627	31.2843	32.7132	36.8943	41.6154	43.7339	(72)
Total internal gains	370.8636	369.4832	356.5682	335.2552	312.6578	291.6411	278.4713	282.4424	293.8150	315.2694	339.9653	359.4076	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	g	FF Specific data or Table 6c	Access factor Table 6d	Gains W
North	3.9300	10.6334	0.4400		0.0000	0.7700	14.1582 (74)
East	0.4800	19.6403	0.4400		0.0000	0.7700	3.1940 (76)
South	5.1600	46.7521	0.4400		0.0000	0.7700	81.7323 (78)
West	6.9700	19.6403	0.4400		0.0000	0.7700	46.3792 (80)

Solar gains	145.4637	257.8892	376.1911	499.4832	585.7541	591.9715	566.4554	501.2305	419.1396	291.6545	176.1586	123.1938	(83)
Total gains	516.3274	627.3725	732.7593	834.7384	898.4119	883.6126	844.9267	783.6730	712.9546	606.9239	516.1239	462.6015	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	39.7200	39.8022	39.8830	40.2672	40.3399	40.6818	40.6818	40.7457	40.5494	40.3399	40.1931	40.0407	
alpha	3.6480	3.6535	3.6589	3.6845	3.6893	3.7121	3.7121	3.7164	3.7033	3.6893	3.6795	3.6694	
util living area	0.9947	0.9887	0.9747	0.9378	0.8576	0.7184	0.5674	0.6220	0.8345	0.9609	0.9903	0.9959	(86)
MIT	19.1619	19.3865	19.7428	20.1968	20.5943	20.8580	20.9560	20.9378	20.7328	20.2008	19.5929	19.1219	(87)
Th 2	19.8291	19.8312	19.8333	19.8431	19.8449	19.8535	19.8535	19.8551	19.8502	19.8449	19.8412	19.8374	(88)
util rest of house	0.9933	0.9857	0.9675	0.9190	0.8125	0.6285	0.4374	0.4929	0.7654	0.9455	0.9872	0.9947	(89)
MIT 2	18.1635	18.3882	18.7418	19.1900	19.5580	19.7796	19.8397	19.8334	19.6894	19.2033	18.6022	18.1298	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.3556	18.5803	18.9345	19.3838	19.7575	19.9872	20.0545	20.0460	19.8902	19.3953	18.7929	18.3207	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3556	18.5803	18.9345	19.3838	19.7575	19.9872	20.0545	20.0460	19.8902	19.3953	18.7929	18.3207	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	511.5154	615.5798	703.6265	759.3779	726.3326	565.6045	390.1278	404.5751	547.6993	569.0498	507.4681	479.0445	(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	1684.5058	1636.1474	1484.1305	1239.3661	950.8152	630.3658	404.2205	425.9539	679.7395	1037.8802	1384.8532	1678.7549	(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	872.7049	685.8214	580.6950	345.5915	167.0150	0.0000	0.0000	0.0000	0.0000	348.8098	631.7173	892.5846	(98)
Space heating												4524.9394	(98)
Space heating per m2												(98) / (4) =	49.6482 (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	1099.9195	865.8941	887.9009	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7992	0.8666	0.8374	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	879.0480	750.3518	743.5459	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1132.7027	1085.3822	1015.5619	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	182.6314	249.2627	202.3799	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												634.2740 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	45.6579	62.3157	50.5950	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												158.5685 (107)
Space cooling per m2												1.7398 (108)
Energy for space heating												49.6482 (99)
Energy for space cooling												1.7398 (108)
Total												51.3881 (109)
Dwelling Fabric Energy Efficiency (DFEE)												51.4 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans	= (6a)+(6b)+(7a)+(7b)+(7c) =				30.0000 / (5) = 0.1360 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3860 (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) =				0.3281 (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	0.4183	0.4101	0.4019	0.3609	0.3527	0.3117	0.3117	0.3035	0.3281	0.3527	0.3691	0.3855 (22b)
Effective ac	0.5875	0.5841	0.5808	0.5651	0.5622	0.5486	0.5486	0.5461	0.5538	0.5622	0.5681	0.5743 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.1500	1.0000	2.1500		(26)
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)
TER Opening Type (Uw = 1.40)			16.5400	1.3258	21.9280		(27)
Heat Loss Floor 1			45.5700	0.1300	5.9241		(28a)
Clad Cavity	132.7600	20.8400	111.9200	0.1800	20.1456		(29a)
Main Plane	45.5700		45.5700	0.1300	5.9241		(30)
Total net area of external elements Aum(A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.6518		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.1552 (36)
Total fabric heat loss						(33) + (36) =	69.8070 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	42.7614	42.5140	42.2716	41.1330	40.9199	39.9282	39.9282	39.7445	40.3102	40.9199	41.3509	41.8015 (38)
Heat transfer coeff	112.5684	112.3211	112.0786	110.9400	110.7269	109.7352	109.7352	109.5515	110.1172	110.7269	111.1579	111.6085 (39)
Average = Sum(39)m / 12 =												110.9390 (39)
HLP	1.2351	1.2324	1.2297	1.2172	1.2149	1.2040	1.2040	1.2020	1.2082	1.2149	1.2196	1.2246 (40)
HLP (average)												1.2172 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (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)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	33.5981	29.3851	30.3228	26.4362	25.3661	21.8890	20.2834	23.2755	23.5535	27.4493	29.9631	32.5380 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	132.0502	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	21.9303	19.4783	15.8408	11.9925	8.9646	7.5683	8.1778	10.6298	14.2673	18.1156	21.1435	22.5398	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	241.1595	243.6619	237.3558	223.9307	206.9839	191.0563	180.4158	177.9133	184.2194	197.6445	214.5913	230.5189	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	36.2050	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	45.1588	43.7279	40.7565	36.7169	34.0943	30.4015	27.2627	31.2843	32.7132	36.8943	41.6154	43.7339	(72)
Total internal gains	370.8636	369.4832	356.5682	335.2552	312.6578	291.6411	278.4713	282.4424	293.8150	315.2694	339.9653	359.4076	(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	3.9300	10.6334	0.6300	0.7000	0.7700	12.7713	(74)
East	0.4800	19.6403	0.6300	0.7000	0.7700	2.8811	(76)
South	5.1600	46.7521	0.6300	0.7000	0.7700	73.7263	(78)
West	6.9700	19.6403	0.6300	0.7000	0.7700	41.8362	(80)

Solar gains	131.2149	232.6278	339.3415	450.5566	528.3768	533.9852	510.9685	452.1327	378.0830	263.0856	158.9031	111.1264	(83)
Total gains	502.0785	602.1110	695.9097	785.8118	841.0346	825.6263	789.4398	734.5751	671.8980	578.3551	498.8684	470.5341	(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	56.2251	56.3489	56.4708	57.0504	57.1601	57.6767	57.6767	57.7734	57.4766	57.1601	56.9385	56.7087	
alpha	4.7483	4.7566	4.7647	4.8034	4.8107	4.8451	4.8451	4.8516	4.8318	4.8107	4.7959	4.7806	
util living area	0.9986	0.9964	0.9899	0.9669	0.8999	0.7558	0.5884	0.6471	0.8752	0.9815	0.9970	0.9990	(86)
MIT	19.6012	19.7732	20.0490	20.4069	20.7221	20.9201	20.9813	20.9708	20.8249	20.4054	19.9339	19.5716	(87)
Th 2	19.8920	19.8942	19.8963	19.9062	19.9081	19.9168	19.9168	19.9184	19.9134	19.9081	19.9043	19.9004	(88)
util rest of house	0.9981	0.9952	0.9861	0.9535	0.8584	0.6623	0.4551	0.5135	0.8079	0.9718	0.9957	0.9986	(89)
MIT 2	18.6195	18.7927	19.0683	19.4260	19.7177	19.8794	19.9120	19.9100	19.8142	19.4308	18.9615	18.5966	(90)
Living area fraction									fLA = Living area / (4) =			0.1925	(91)
MIT	18.8084	18.9814	19.2570	19.6148	19.9110	20.0797	20.1178	20.1142	20.0087	19.6184	19.1486	18.7843	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.8084	18.9814	19.2570	19.6148	19.9110	20.0797	20.1178	20.1142	20.0087	19.6184	19.1486	18.7843	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9974	0.9937	0.9831	0.9490	0.8585	0.6778	0.4811	0.5394	0.8149	0.9683	0.9945	0.9981	(94)
Ext temp.	500.7923	598.3248	684.1666	745.7037	722.0174	559.6134	379.7701	396.2240	547.5594	559.9968	496.1135	469.6468	(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	1633.1913	1581.6369	1429.7884	1188.6943	909.1783	601.3127	386.0268	406.8928	650.6474	998.5780	1339.3012	1627.7287	(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 per m ²	842.5049	660.7857	554.7427	318.9532	139.2477	0.0000	0.0000	0.0000	0.0000	326.3044	607.0951	861.6130	(98)
												4311.2466	(98)
											(98) / (4) =	47.3036	(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	1031.5109	812.0405	832.5918	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8419	0.9084	0.8817	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	868.3828	737.6568	734.1106	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	1064.9265	1020.5274	958.1749	0.0000	0.0000	0.0000	0.0000	(103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	(103a)
Space cooling kWh													

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	0.0000	0.0000	0.0000	0.0000	0.0000	141.5114	210.4557	166.7039	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												518.6710 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	35.3779	52.6139	41.6760	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												129.6678 (107)
Space cooling per m2												1.4227 (108)
Energy for space heating												47.3036 (99)
Energy for space cooling												1.4227 (108)
Total												48.7263 (109)
Target Fabric Energy Efficiency (TFEE)												56.0 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Clad Cavity	132.7600	20.8400	111.9200	0.2400	26.8608	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8767		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 77.0845 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	118.8706	118.3691	118.3691	117.6628	117.6628	116.8066	117.0115	116.6079	116.8066	117.2225	117.2225	117.8921 (39)
Average = Sum(39)m / 12 =												117.5420 (39)
HLP	1.3043	1.2988	1.2988	1.2910	1.2910	1.2816	1.2839	1.2794	1.2816	1.2862	1.2862	1.2935 (40)
HLP (average)												1.2897 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

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Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
RHI water heating demand												
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
												1690 (64)
												1690 (64)
												1690 (64)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(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			3.9300		11.9814		0.4400		0.0000		0.7700		15.9531 (74)
East			0.4800		22.3313		0.4400		0.0000		0.7700		3.6316 (76)
South			5.1600		50.9848		0.4400		0.0000		0.7700		89.1321 (78)
West			6.9700		22.3313		0.4400		0.0000		0.7700		52.7340 (80)
Solar gains	161.4508	257.8650	372.5663	511.7584	586.4964	635.1253	600.8511	542.3625	450.6128	311.6373	200.3604		135.3821 (83)
Total gains	760.9334	852.7097	944.2460	1047.4439	1085.2039	1100.7786	1047.2276	997.4400	926.4393	823.6794	752.6678		718.2734 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.0043	41.1780	41.1780	41.4252	41.4252	41.7289	41.6558	41.8000	41.7289	41.5808	41.5808	41.3446	
alpha	3.7336	3.7452	3.7452	3.7617	3.7617	3.7819	3.7771	3.7867	3.7819	3.7721	3.7721	3.7563	
util living area	0.9797	0.9682	0.9391	0.8672	0.7305	0.5068	0.3422	0.3684	0.6537	0.8878	0.9634	0.9830 (86)	
MIT	19.6065	19.7844	20.1186	20.5144	20.8186	20.9679	20.9947	20.9930	20.9121	20.5470	20.0237	19.5742 (87)	
Th 2	19.8375	19.8418	19.8418	19.8479	19.8479	19.8553	19.8535	19.8570	19.8553	19.8517	19.8517	19.8459 (88)	
util rest of house	0.9744	0.9599	0.9227	0.8315	0.6602	0.4007	0.2177	0.2396	0.5519	0.8488	0.9520	0.9785 (89)	
MIT 2	18.0357	18.2935	18.7680	19.3121	19.6881	19.8388	19.8525	19.8555	19.7971	19.3717	18.6474	17.9949 (90)	
Living area fraction									fLA = Living area / (4) =			0.1925 (91)	
MIT	18.3380	18.5804	19.0279	19.5435	19.9057	20.0561	20.0723	20.0744	20.0117	19.5978	18.9122	18.2988 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.1880	18.4304	18.8779	19.3935	19.7557	19.9061	19.9223	19.9244	19.8617	19.4478	18.7622	18.1488 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9634	0.9460	0.9050	0.8146	0.6539	0.4057	0.2253	0.2474	0.5525	0.8317	0.9372	0.9687	(94)
Useful gains	733.0737	806.6854	854.5733	853.2631	709.5937	446.5607	235.9656	246.7687	511.8612	685.0946	705.3731	695.7627	(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	1555.7771	1518.7242	1358.6315	1117.0344	794.8930	456.2589	236.6314	247.7235	544.5119	919.9440	1261.5772	1538.3538	(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	612.0913	478.4901	375.0193	189.9153	63.4626	0.0000	0.0000	0.0000	0.0000	174.7280	400.4669	626.8878	(98)
Space heating												2921.0613	(98)
RHI space heating demand												2921	(98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5813	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Clad Cavity	132.7600	20.8400	111.9200	0.2400	26.8608	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8767		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 77.0845 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	121.4299	121.1211	120.8184	119.3965	119.1305	117.8921	117.8921	117.6628	118.3691	119.1305	119.6687	120.2313 (39)
Average = Sum(39)m / 12 =												119.3953 (39)
HLP	1.3323	1.3290	1.3256	1.3100	1.3071	1.2935	1.2935	1.2910	1.2988	1.3071	1.3130	1.3192 (40)
HLP (average)												1.3100 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(66)m	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402 (71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766 (72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913 (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	3.9300	10.6334	0.4400	0.0000	0.7700	14.1582 (74)
East	0.4800	19.6403	0.4400	0.0000	0.7700	3.1940 (76)
South	5.1600	46.7521	0.4400	0.0000	0.7700	81.7323 (78)
West	6.9700	19.6403	0.4400	0.0000	0.7700	46.3792 (80)

Solar gains	145.4637	257.8892	376.1911	499.4832	585.7541	591.9715	566.4554	501.2305	419.1396	291.6545	176.1586	123.1938 (83)
Total gains	744.9464	852.7339	947.8709	1035.1687	1084.4616	1057.6247	1012.8319	956.3080	894.9661	803.6966	728.4660	706.0852 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	40.1401	40.2424	40.3433	40.8237	40.9149	41.3446	41.3446	41.4252	41.1780	40.9149	40.7309	40.5403
alpha	3.6760	3.6828	3.6896	3.7216	3.7277	3.7563	3.7563	3.7617	3.7452	3.7277	3.7154	3.7027
util living area	0.9839	0.9727	0.9496	0.8966	0.7968	0.6415	0.4910	0.5351	0.7518	0.9196	0.9733	0.9866 (86)
MIT	19.4329	19.6429	19.9677	20.3718	20.7034	20.9072	20.9739	20.9639	20.8245	20.3918	19.8402	19.3941 (87)
Th 2	19.8156	19.8182	19.8208	19.8330	19.8353	19.8459	19.8459	19.8479	19.8418	19.8353	19.8306	19.8258 (88)
util rest of house	0.9798	0.9657	0.9364	0.8688	0.7421	0.5497	0.3717	0.4144	0.6700	0.8919	0.9653	0.9832 (89)
MIT 2	17.7698	18.0739	18.5395	19.1099	19.5423	19.7796	19.8348	19.8310	19.6990	19.1520	18.3706	17.7204 (90)
Living area fraction	18.0899	18.3758	18.8144	19.3527	19.7657	19.9966	20.0540	20.0490	19.9156	19.3906	18.6535	18.0425 (92)
MIT	18.0899	18.3758	18.8144	19.3527	19.7657	19.9966	20.0540	20.0490	19.9156	19.3906	18.6535	18.0425 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9399	18.2258	18.6644	19.2027	19.6157	19.8466	19.9040	19.8990	19.7656	19.2406	18.5035	17.8925 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	0.9701	0.9526	0.9193	0.8504	0.7302	0.5497	0.3780	0.4200	0.6639	0.8736	0.9523	0.9747 (94)
Ext temp.	722.6858	812.3322	871.3654	880.2568	791.9233	581.3997	382.8287	401.6781	594.1336	702.1319	693.6938	688.2002 (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	1656.2879	1614.0409	1469.6823	1230.1095	943.0066	618.5303	389.5188	411.7052	670.6291	1029.3632	1364.6377	1646.2633 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)
Space heating per m2	694.6000	538.7482	445.1477	251.8940	112.4060	0.0000	0.0000	0.0000	0.0000	243.4601	483.0796	712.7989 (98)
												3482.1347 (98)
												(98) / (4) = 38.2064 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Energy Ratings 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3847.6626	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	694.6000	538.7482	445.1477	251.8940	112.4060	0.0000	0.0000	0.0000	0.0000	243.4601	483.0796	712.7989	(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)	767.5138	595.3019	491.8760	278.3359	124.2056	0.0000	0.0000	0.0000	0.0000	269.0167	533.7897	787.6231	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)	
Efficiency of water heater (217)m	89.8456	89.7794	89.6441	89.3409	88.7349	87.3000	87.3000	87.3000	87.3000	89.2877	89.7026	89.8739	(217)	
Fuel for water heating, kWh/month	191.7120	168.2347	174.9036	154.4667	150.3216	133.4888	125.3239	141.4982	142.5034	160.4212	172.4075	186.0873	(219)	
Water heating fuel used												1901.3691	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3847.6626	(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)													387.2964	(232)
Total delivered energy for all uses													6211.3281	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3847.6626	3.4800	133.8987 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1901.3691	3.4800	66.1676 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	387.2964	13.1900	51.0844 (250)
Additional standing charges			120.0000 (251)
Total energy cost			381.0432 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.1755 (257)
SAP value	83.6012
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	3847.6626	0.2160	831.0951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1901.3691	0.2160	410.6957 (264)
Space and water heating			1241.7909 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total kg/year			1481.7227 (272)
CO2 emissions per m2			16.2600 (273)
EI value			85.4157
EI rating			85 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8878 = 3.920$, stars = 4
Water heating environmental impact	$0.216 / 0.8878 = 0.2433$, stars = 4

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Clad Cavity	132.7600	20.8400	111.9200	0.2400	26.8608	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8767		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
Total fabric heat loss (33) + (36) = 77.0845 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	118.8706	118.3691	118.3691	117.6628	117.6628	116.8066	117.0115	116.6079	116.8066	117.2225	117.2225	117.8921 (39)
Average = Sum(39)m / 12 =												117.5420 (39)
HLP	1.3043	1.2988	1.2988	1.2910	1.2910	1.2816	1.2839	1.2794	1.2816	1.2862	1.2862	1.2935 (40)
HLP (average)												1.2897 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)												
Total per year (kWh/year) = Sum(64)m = 1690.4768 (64)												

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(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	3.9300	11.9814	0.4400	0.0000	0.7700	15.9531 (74)
East	0.4800	22.3313	0.4400	0.0000	0.7700	3.6316 (76)
South	5.1600	50.9848	0.4400	0.0000	0.7700	89.1321 (78)
West	6.9700	22.3313	0.4400	0.0000	0.7700	52.7340 (80)

Solar gains	161.4508	257.8650	372.5663	511.7584	586.4964	635.1253	600.8511	542.3625	450.6128	311.6373	200.3604	135.3821 (83)
Total gains	760.9334	852.7097	944.2460	1047.4439	1085.2039	1100.7786	1047.2276	997.4400	926.4393	823.6794	752.6678	718.2734 (84)

7. Mean internal temperature (heating season)

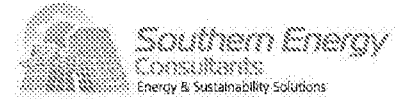
Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.0043	41.1780	41.1780	41.4252	41.4252	41.7289	41.6558	41.8000	41.7289	41.5808	41.5808	41.3446	
alpha	3.7336	3.7452	3.7452	3.7617	3.7617	3.7819	3.7771	3.7867	3.7819	3.7721	3.7721	3.7563	
util living area	0.9797	0.9682	0.9391	0.8672	0.7305	0.5068	0.3422	0.3684	0.6537	0.8878	0.9634	0.9830 (86)	
MIT	19.6065	19.7844	20.1186	20.5144	20.8186	20.9679	20.9947	20.9930	20.9121	20.5470	20.0237	19.5742 (87)	
Th 2	19.8375	19.8418	19.8418	19.8479	19.8479	19.8553	19.8535	19.8570	19.8553	19.8517	19.8517	19.8459 (88)	
util rest of house	0.9744	0.9599	0.9227	0.8315	0.6602	0.4007	0.2177	0.2396	0.5519	0.8488	0.9520	0.9785 (89)	
MIT 2	18.0357	18.2935	18.7680	19.3121	19.6881	19.8388	19.8525	19.8555	19.7971	19.3717	18.6474	17.9949 (90)	
Living area fraction	18.3380	18.5804	19.0279	19.5435	19.9057	20.0561	20.0723	20.0744	20.0117	19.5978	18.9122	18.2988 (92)	
MIT	18.1880	18.4304	18.8779	19.3935	19.7557	19.9061	19.9223	19.9244	19.8617	19.4478	18.7622	18.1488 (93)	
Temperature adjustment												-0.1500	
adjusted MIT													

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9634	0.9460	0.9050	0.8146	0.6539	0.4057	0.2253	0.2474	0.5525	0.8317	0.9372	0.9687 (94)	
Ext temp.	733.0737	806.6854	854.5733	853.2631	709.5937	446.5607	235.9656	246.7687	511.8612	685.0946	705.3731	695.7627 (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	1555.7771	1518.7242	1358.6315	1117.0344	794.8930	456.2589	236.6314	247.7235	544.5119	919.9440	1261.5772	1538.3538 (97)	
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000 (97a)	
Space heating per m2	612.0913	478.4901	375.0193	189.9153	63.4626	0.0000	0.0000	0.0000	0.0000	174.7280	400.4669	626.8878 (98)	
												2921.0613 (98)	
												32.0503 (99)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3227.6921 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.0913	478.4901	375.0193	189.9153	63.4626	0.0000	0.0000	0.0000	0.0000	174.7280	400.4669	626.8878	(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)	676.3440	528.7183	414.3860	209.8512	70.1245	0.0000	0.0000	0.0000	0.0000	193.0696	442.5049	692.6937	(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	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440	(64)
Efficiency of water heater (217)m	89.7773	89.7110	89.5324	89.1251	88.3066	87.3000	87.3000	87.3000	87.3000	89.0299	89.5852	89.8067	(217)
Fuel for water heating, kWh/month	191.8579	168.3629	175.1218	154.8406	151.0505	133.4888	125.3239	141.4982	142.5034	160.8857	172.6336	186.2266	(219)
Water heating fuel used												1903.7940	(219)
Annual totals kWh/year													
Space heating fuel - main system												3227.6921	(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)												387.2964	(232)
Total delivered energy for all uses												5593.7825	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	3227.6921	3.8700	124.9117 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1903.7940	3.8700	73.6768 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	387.2964	18.9000	73.1990 (250)
Additional standing charges			93.0000 (251)
Total energy cost			378.9625 (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	3227.6921	0.2160	697.1815 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.7940	0.2160	411.2195 (264)
Space and water heating			1108.4010 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Total kg/year			1348.3328 (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	3227.6921	1.2200	3937.7843 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1903.7940	1.2200	2322.6287 (264)
Space and water heating			6260.4130 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	387.2964	3.0700	1189.0000 (268)
Primary energy kWh/year			7679.6630 (272)
Primary energy kWh/m2/year			84.2623 (273)

SAP 2012 EPC IMPROVEMENTS

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

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

Recommended measures:	SAP change	Cost change	CO2 change
N Solar water heating	+ 1.2	-£ 29	-187 kg (13.8%)
U Solar photovoltaic panels	+ 9.8	-£ 345	-947 kg (81.5%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£29	2.05 kg/m²	B 85 B 87
Solar photovoltaic panels	£345	10.39 kg/m²	A 95 A 96
Total Savings	£373	12.44 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	£87	£97	-£9
Mains gas	£292	£254	£38
Space heating	£232	£232	£0
Water heating	£74	£45	£29
Lighting	£73	£73	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£379	£6	£374
Total cost of uses	£379	£5	£374
Delivered energy	61 kWh/m²	31 kWh/m²	30 kWh/m²
Carbon dioxide emissions	1.3 tonnes	0.2 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	2 kg/m²	12 kg/m²
Primary energy	84 kWh/m²	11 kWh/m²	73 kWh/m²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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)	=	0.3667 (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	0.4675	0.4583	0.4492	0.4033	0.3942	0.3483	0.3483	0.3392	0.3667	0.3942	0.4125	0.4308 (22b)
Effective ac	0.6093	0.6050	0.6009	0.5613	0.5777	0.5607	0.5607	0.5575	0.5672	0.5777	0.5851	0.5928 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Clad Cavity	132.7600	20.8400	111.9200	0.2400	26.8608	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8767		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
 Total fabric heat loss (33) + (36) = 77.0845 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	44.3454	44.0366	43.7338	42.3120	42.0460	40.8076	40.8076	40.5783	41.2846	42.0460	42.5841	43.1468 (38)
Heat transfer coeff	121.4299	121.1211	120.8184	119.3965	119.1305	117.8921	117.8921	117.6628	118.3691	119.1305	119.6687	120.2313 (39)
Average = Sum(39)m / 12 =												119.3953 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.3323	1.3290	1.3256	1.3100	1.3071	1.2935	1.2935	1.2910	1.2988	1.3071	1.3130	1.3192 (40)
HLP (average)												1.3100 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

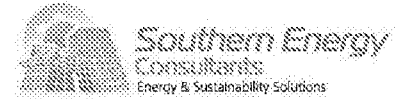
Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1079.5246 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1813.6014 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.1893 (H8)
Utilisation factor												0.5687 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.9239 (H14)
Volume ratio Veff/V												0.7738 (H15)
Solar storage volume factor												0.9487 (H16)
Solar input												-860.3285 (H17)
Solar input	-24.9478	-41.6307	-70.9019	-95.0225	-117.3923	-115.4153	-113.8901	-99.5063	-77.9334	-53.2193	-29.5917	-20.8771 (63)
Solar input (sum of months) = Sum(63)m =												-860.3285 (63)
Output from w/h	147.2970	109.4094	85.8889	42.9794	15.9953	1.1204	0.0000	24.0216	46.4721	90.0171	125.0623	146.3669 (64)
Total per year (kWh/year) = Sum(64)m =												834.6306 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(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	3.9300	10.6334	0.4400	0.0000	0.7700	14.1582 (74)
East	0.4800	19.6403	0.4400	0.0000	0.7700	3.1940 (76)
South	5.1600	46.7521	0.4400	0.0000	0.7700	81.7323 (78)
West	6.9700	19.6403	0.4400	0.0000	0.7700	46.3792 (80)

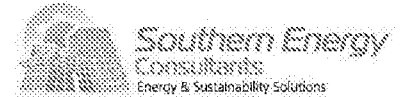
Solar gains	145.4637	257.8892	376.1911	499.4832	585.7541	591.9715	566.4554	501.2305	419.1396	291.6545	176.1586	123.1938 (83)
Total gains	744.9464	852.7339	947.8709	1035.1687	1084.4616	1057.6247	1012.8319	956.3080	894.9661	803.6966	728.4660	706.0852 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
tau	40.1401	40.2424	40.3433	40.8237	40.9149	41.3446	41.3446	41.4252	41.1780	40.9149	40.7309	40.5403
alpha	3.6760	3.6828	3.6896	3.7216	3.7277	3.7563	3.7563	3.7617	3.7452	3.7277	3.7154	3.7027
util living area	0.9839	0.9727	0.9496	0.8966	0.7968	0.6415	0.4910	0.5351	0.7518	0.9196	0.9733	0.9866 (86)
MIT	19.4329	19.6429	19.9677	20.3718	20.7034	20.9072	20.9739	20.9639	20.8245	20.3918	19.8402	19.3941 (87)
Th 2	19.8156	19.8182	19.8208	19.8330	19.8353	19.8459	19.8459	19.8479	19.8418	19.8353	19.8306	19.8258 (88)
util rest of house	0.9798	0.9657	0.9364	0.8688	0.7421	0.5497	0.3717	0.4144	0.6700	0.8919	0.9653	0.9832 (89)
MIT 2	17.7698	18.0739	18.5395	19.1099	19.5423	19.7796	19.8348	19.8310	19.6990	19.1520	18.3706	17.7204 (90)
Living area fraction									fLA = Living area / (4) =			0.1925 (91)
MIT	18.0899	18.3758	18.8144	19.3527	19.7657	19.9966	20.0540	20.0490	19.9156	19.3906	18.6535	18.0425 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9399	18.2258	18.6644	19.2027	19.6157	19.8466	19.9040	19.8990	19.7656	19.2406	18.5035	17.8925 (93)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Energy Ratings for Improved Dwelling 09 Jan 2014

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9701	0.9526	0.9193	0.8504	0.7302	0.5497	0.3780	0.4200	0.6639	0.8736	0.9523	0.9747	(94)
Useful gains	722.6858	812.3322	871.3654	880.2568	791.9233	581.3997	382.8287	401.6781	594.1336	702.1319	693.6938	688.2002	(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	1656.2879	1614.0409	1469.6823	1230.1095	943.0066	618.5303	389.5188	411.7052	670.6291	1029.3632	1364.6377	1646.2633	(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	694.6000	538.7482	445.1477	251.8940	112.4060	0.0000	0.0000	0.0000	0.0000	243.4601	483.0796	712.7989	(98)
Space heating													
Space heating per m2													(98) / (4) = 38.2064 (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													3847.6626 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	694.6000	538.7482	445.1477	251.8940	112.4060	0.0000	0.0000	0.0000	0.0000	243.4601	483.0796	712.7989	(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)	767.5138	595.3019	491.8760	278.3359	124.2056	0.0000	0.0000	0.0000	0.0000	269.0167	533.7897	787.6231	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	147.2970	109.4094	85.8889	42.9794	15.9953	1.1204	0.0000	24.0216	46.4721	90.0171	125.0623	146.3669	(64)
Efficiency of water heater	89.9233	89.9435	89.9666	90.0191	90.0886	87.3000	87.3000	87.3000	87.3000	89.6133	89.8229	89.9384	(216)
(217)m	89.9233	89.9435	89.9666	90.0191	90.0886	87.3000	87.3000	87.3000	87.3000	89.6133	89.8229	89.9384	(217)
Fuel for water heating, kWh/month	163.8029	121.6424	95.4675	47.7448	17.7551	1.2834	0.0000	27.5162	53.2326	100.4506	139.2321	162.7414	(219)
Water heating fuel used													930.8690 (219)
Annual totals kWh/year													
Space heating fuel - main system													3847.6626 (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)													387.2964 (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													3563.5887 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3847.6626	3.4800	133.8987	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	930.8690	3.4800	32.3942	(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	387.2964	13.1900	51.0844	(250)
Additional standing charges			120.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			126.0419	(255)

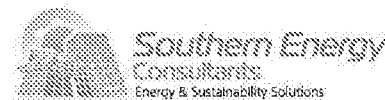
11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.3888 (257)
SAP value		94.5756
SAP rating (Section 12)		95 (258)
SAP band		A

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

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	3847.6626	0.2160	831.0951 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	930.8690	0.2160	201.0677 (264)
Space and water heating			1032.1628 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	387.2964	0.5190	201.0068 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			401.6074 (272)
CO2 emissions per m2			4.4100 (273)
EI value			96.0471
EI rating			96 (274)
EI band			A

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	45.5700 (1b)	x 2.3100 (2b)	= 105.2667 (1b) - (3b)
First floor	45.5700 (1c)	x 2.5300 (2c)	= 115.2921 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	91.1400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	220.5588 (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) = 0.1814 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4314 (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) =		0.3667 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate	0.3850	0.3667	0.3667	0.3392	0.3392	0.3025	0.3117	0.2933	0.3025	0.3208	0.3208	0.3483 (22b)
Effective ac	0.5741	0.5672	0.5672	0.5575	0.5575	0.5457	0.5486	0.5430	0.5457	0.5515	0.5515	0.5607 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			16.5400	1.2357	20.4392		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			45.5700	0.2000	9.1140	75.0000	3417.7500 (28a)
Clad Cavity	132.7600	20.8400	111.9200	0.2400	26.8608	60.0000	6715.2000 (29a)
Main Plane	45.5700		45.5700	0.1100	5.0127	9.0000	410.1300 (30)
Total net area of external elements Aum (A, m ²)			223.9000				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		67.8767		(33)
Internal Wall 1			52.0200			75.0000	3901.5000 (32c)
Internal Wall 2			162.4500			9.0000	1462.0500 (32c)
Internal Floor 1			45.5700			18.0000	820.2600 (32d)
Internal Ceiling 1			45.5700			18.0000	820.2600 (32e)

Heat capacity Cm = Sum(A x k) (28)...(30) + (32) + (32a)...(32e) = 17547.1500 (34)
 Thermal mass parameter (TMP = Cm / TFA) in kJ/m²K 192.5296 (35)
 Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.2079 (36)
 Total fabric heat loss (33) + (36) = 77.0845 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
(38)m	41.7861	41.2846	41.2846	40.5783	40.5783	39.7221	39.9270	39.5233	39.7221	40.1379	40.1379	40.8076 (38)
Heat transfer coeff	118.8706	118.3691	118.3691	117.6628	117.6628	116.8066	117.0115	116.6079	116.8066	117.2225	117.2225	117.8921 (39)
Average = Sum(39)m / 12 =												117.5420 (39)
HLP	1.3043	1.2988	1.2988	1.2910	1.2910	1.2816	1.2839	1.2794	1.2816	1.2862	1.2862	1.2935 (40)
HLP (average)												1.2897 (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												2.6410 (42)
Average daily hot water use (litres/day)												96.9239 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	106.6163	102.7393	98.8623	94.9854	91.1084	87.2315	87.2315	91.1084	94.9854	98.8623	102.7393	106.6163 (44)
Energy conte	158.1088	138.2830	142.6957	124.4055	119.3701	103.0073	95.4514	109.5319	110.8400	129.1734	141.0028	153.1200 (45)
Energy content (annual)										Total = Sum(45)m =		1524.9898 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Distribution loss (46)m = 0.15 x (45)m	23.7163	20.7424	21.4043	18.6608	17.9055	15.4511	14.3177	16.4298	16.6260	19.3760	21.1504	22.9680 (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	14.1360	12.7572	14.0951	13.5964	14.0176	13.5285	13.9564	13.9961	13.5655	14.0630	13.6512	14.1240 (61)
Total heat required for water heating calculated for each month	172.2448	151.0401	156.7908	138.0019	133.3876	116.5357	109.4078	123.5279	124.4055	143.2364	154.6540	167.2440 (62)
Aperture area of solar collector												3.0000 (H1)
Zero-loss collector efficiency												0.7000 (H2)
Collector heat loss coefficient												1.8000 (H3)
Collector 2nd order heat loss coefficient												0.0050 (H3a)
Collector effective heat loss coefficient												1.8063 (H3b)
Collector performance ratio												2.5804 (H4)
Annual solar radiation per m2												1140.0998 (H5)
Overshading factor												0.8000 (H6)
Solar energy available												1915.3676 (H7)
Adjustment factor for showers												1.0000 (H7a)
Solar-to-load ratio												1.2560 (H8)
Utilisation factor												0.5490 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												96.9239 (H14)
Volume ratio Veff/V												0.7738 (H15)
Solar storage volume factor												0.9487 (H16)
Solar input												-877.1154 (H17)
Solar input	-26.9972	-40.5767	-68.3363	-94.4617	-113.7636	-119.7313	-116.8563	-104.3534	-81.4482	-55.4077	-32.8158	-22.3673 (63)
Solar input (sum of months) = Sum(63)m =												-877.1154 (63)
Output from w/h	145.2477	110.4634	88.4545	43.5402	19.6240	0.0000	0.0000	19.1746	42.9573	87.8287	121.8383	144.8767 (64)
Total per year (kWh/year) = Sum(64)m =												824.0055 (64)
Heat gains from water heating, kWh/month	56.1052	49.1684	50.9701	44.7639	43.1949	37.6320	35.2267	39.9184	40.2457	46.4659	50.2962	54.4434 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	158.4603	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	54.8258	48.6958	39.6021	29.9813	22.4114	18.9206	20.4444	26.5744	35.6681	45.2889	52.8588	56.3496	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	359.9395	363.6745	354.2623	334.2249	308.9312	285.1587	269.2772	265.5422	274.9544	294.9918	320.2855	344.0580	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	53.4870	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	-105.6402	(71)
Water heating gains (Table 5)	75.4102	73.1672	68.5082	62.1721	58.0577	52.2667	47.3477	53.6537	55.8968	62.4542	69.8559	73.1766	(72)
Total internal gains	599.4826	594.8447	571.6798	535.6855	498.7075	465.6532	446.3765	455.0775	475.8265	512.0421	552.3074	582.8913	(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					3.9300	11.9814	0.4400	0.0000	0.7700		15.9531 (74)	
East					0.4800	22.3313	0.4400	0.0000	0.7700		3.6316 (76)	
South					5.1600	50.9848	0.4400	0.0000	0.7700		89.1321 (78)	
West					6.9700	22.3313	0.4400	0.0000	0.7700		52.7340 (80)	

Solar gains	161.4508	257.8650	372.5663	511.7584	586.4964	635.1253	600.8511	542.3625	450.6128	311.6373	200.3604	135.3821 (83)
Total gains	760.9334	852.7097	944.2460	1047.4439	1085.2039	1100.7786	1047.2276	997.4400	926.4393	823.6794	752.6678	718.2734 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
tau	41.0043	41.1780	41.1780	41.4252	41.4252	41.7289	41.6558	41.8000	41.7289	41.5808	41.5808	41.3446	
alpha	3.7336	3.7452	3.7452	3.7617	3.7617	3.7819	3.7771	3.7867	3.7819	3.7721	3.7721	3.7563	
util living area	0.9797	0.9682	0.9391	0.8672	0.7305	0.5068	0.3422	0.3684	0.6537	0.8878	0.9634	0.9830 (86)	
MIT	19.6065	19.7844	20.1186	20.5144	20.8186	20.9679	20.9947	20.9930	20.9121	20.5470	20.0237	19.5742 (87)	
Th 2	19.8375	19.8418	19.8418	19.8479	19.8479	19.8553	19.8535	19.8570	19.8553	19.8517	19.8517	19.8459 (88)	
util rest of house	0.9744	0.9599	0.9227	0.8315	0.6602	0.4007	0.2177	0.2396	0.5519	0.8488	0.9520	0.9785 (89)	
MIT 2	18.0357	18.2935	18.7680	19.3121	19.6881	19.8388	19.8525	19.8555	19.7971	19.3717	18.6474	17.9949 (90)	
Living area fraction									fLA = Living area / (4) =			0.1925 (91)	
MIT	18.3380	18.5804	19.0279	19.5435	19.9057	20.0561	20.0723	20.0744	20.0117	19.5978	18.9122	18.2988 (92)	
Temperature adjustment												-0.1500	
adjusted MIT	18.1880	18.4304	18.8779	19.3935	19.7557	19.9061	19.9223	19.9244	19.8617	19.4478	18.7622	18.1488 (93)	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9634	0.9460	0.9050	0.8146	0.6539	0.4057	0.2253	0.2474	0.5525	0.8317	0.9372	0.9687	(94)
Useful gains	733.0737	806.6854	854.5733	853.2631	709.5937	446.5607	235.9656	246.7687	511.8612	685.0946	705.3731	695.7627	(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	1555.7771	1518.7242	1358.6315	1117.0344	794.8930	456.2589	236.6314	247.7235	544.5119	919.9440	1261.5772	1538.3538	(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	612.0913	478.4901	375.0193	189.9153	63.4626	0.0000	0.0000	0.0000	0.0000	174.7280	400.4669	626.8878	(98)
Space heating													(98)
Space heating per m2													(98) / (4) = 32.0503 (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													3227.6921 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	612.0913	478.4901	375.0193	189.9153	63.4626	0.0000	0.0000	0.0000	0.0000	174.7280	400.4669	626.8878	(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)	676.3440	528.7183	414.3860	209.8512	70.1245	0.0000	0.0000	0.0000	0.0000	193.0696	442.5049	692.6937	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	145.2477	110.4634	88.4545	43.5402	19.6240	0.0000	0.0000	19.1746	42.9573	87.8287	121.8383	144.8767	(64)
Efficiency of water heater	89.8682	89.8821	89.8713	89.8855	89.7232	87.3000	87.3000	87.3000	87.3000	89.4038	89.7327	89.8815	(217)
Fuel for water heating, kWh/month	161.6229	122.8982	98.4235	48.4397	21.8717	0.0000	0.0000	21.9640	49.2066	98.2383	135.7791	161.1863	(219)
Water heating fuel used													(219)
Annual totals kWh/year													
Space heating fuel - main system													3227.6921 (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)													387.2964 (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													2835.4591 (238)

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

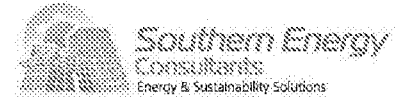
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3227.6921	3.8700	124.9117	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	919.6303	3.8700	35.5897	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	387.2964	18.9000	73.1990	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			5.5592	(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	3227.6921	0.2160	697.1815	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	919.6303	0.2160	198.6401	(264)
Space and water heating			895.8216	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	387.2964	0.5190	201.0068	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Total kg/year 214.9646 (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	3227.6921	1.2200	3937.7843 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	919.6303	1.2200	1121.9489 (264)
Space and water heating			5059.7333 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	387.2964	3.0700	1189.0000 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			1032.3131 (272)
Primary energy kWh/m2/year			11.3267 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	192.5 (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	291.14 (P1)
Transmission heat loss coefficient	77.08 (37)
Summer heat loss coefficient	368.22 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North	3.9300	81.1852	0.4400	0.0000	0.9000	126.3469
East	0.4800	117.5071	0.4400	0.0000	0.9000	22.3357
South	5.1600	112.2060	0.4400	0.0000	0.9000	229.2772
West	6.9700	117.5071	0.4400	0.0000	0.9000	324.3336

total: 702.2935

	Jun	Jul	Aug	
Solar gains	742	702	634	(P4)
Internal gains	463	443	452	
Total summer gains	1205	1146	1086	(P5)

Summer gain/loss ratio	3.27	3.11	2.95	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 192.5)	0.65	0.65	0.65	
Threshold temperature	19.92	21.66	21.40	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight