

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG012a		Issued on Date	04/02/2021	
Assessment Reference	001	Prop Type Ref	Sem Bri Ga Ea		
Property	Hanbury +, Plot 52,53				
SAP Rating	83 B	DER	18.31	TET	19.15
Environmental	87 B	% DER<TER	4.39		
CO ₂ Emissions (t/year)	1.06	DPEE	49.17	TPEE	53.39
General Requirements Compliance	Pass	% DPEE<TPEE	7.90		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Midlands Valley [REDACTED]				

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 70 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) 19.15 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.31 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.31 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

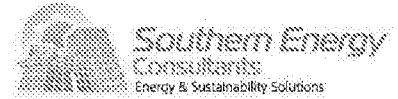
Overshading: Average
Windows facing East: 7.74 m², No overhang
Windows facing West: 4.85 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features

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

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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	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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) =	0.3635 (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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3635	0.3907	0.4089	0.4271 (22b)
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5836	0.5912 (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			2.0600	1.4000	2.8840		(26)
Opening Type 2 (Uw = 1.30)			12.5900	1.2357	15.5580		(27)
Heat Loss Floor 1			35.8800	0.1900	6.8172	75.0000	2691.0000 (28a)
Brick Cavity	82.1100	14.6500	67.4600	0.2500	16.8650	60.0000	4047.6000 (29a)
External Roof 1	34.2800		34.2800	0.1100	3.7708	9.0000	308.5200 (30)
Porch Roof	1.9500		1.9500	0.1100	0.2145	9.0000	17.5500 (30)
Total net area of external elements Aum (A, m ²)			154.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1095		(33)
Party Wall 1			37.5200	0.0000	0.0000	110.0000	4127.2000 (32)
Internal Wall 1			126.7100			9.0000	1140.3900 (32c)
Internal Wall 2			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			34.2800			18.0000	617.0400 (32d)
Internal Ceiling 1			34.2800			18.0000	617.0400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15177.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3247 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9427 (36)
Total fabric heat loss						(33) + (36) =	55.0522 (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	33.8582	33.6258	33.3980	32.3279	32.1277	31.1957	31.1957	31.0231	31.5547	32.1277	32.5327	32.9561 (38)
Heat transfer coeff	88.9104	88.6780	88.4502	87.3801	87.1799	86.2479	86.2479	86.0753	86.6069	87.1799	87.5849	88.0083 (39)
Average = Sum(39)m / 12 =												87.3791 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2673	1.2639	1.2607	1.2454	1.2426	1.2293	1.2293	1.2268	1.2344	1.2426	1.2484	1.2544 (40)
HLP (average)												1.2454 (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												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy conte	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1378.8803 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.4441	18.7551	19.3536	16.8729	16.1900	13.9707	12.9459	14.8556	15.0331	17.5196	19.1240	20.7674 (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	14.0873	12.7040	14.0334	13.5447	13.9700	13.4891	13.9199	13.9524	13.5194	14.0071	13.5970 (61)
Total heat required for water heating calculated for each month											
157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264 (64)
Total per year (kWh/year) = Sum(64)m =	1543.7815 (64)										
Heat gains from water heating, kWh/month											
51.0562	44.7498	46.4088	40.7878	39.3803	34.3407	32.1768	36.4181	36.7031	42.3369	45.7908	49.5537 (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	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0077	15.9942	13.0074	9.8474	7.3611	6.2145	6.7150	8.7284	11.7153	14.8752	17.3616	18.5082	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.6702	199.7214	194.5525	183.5484	169.6577	156.6024	147.8807	145.8295	150.9984	162.0025	175.8932	188.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	(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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	(71)
Water heating gains (Table 5)	68.6239	66.5920	62.3774	56.6498	52.9305	47.6954	43.2484	48.9491	50.9766	56.9044	63.5983	66.6044	(72)
Total internal gains	344.0518	342.0577	329.6873	309.7956	289.6993	270.2624	257.5941	263.2570	273.4403	293.5322	316.6032	333.8111	(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
East					7.7400	19.6403	0.4400	0.0000			0.7700			51.5029 (76)
West					4.8500	19.6403	0.4400	0.0000			0.7700			32.2725 (80)

Solar gains	83.7754	163.8824	269.8910	393.6200	482.3960	493.8182	470.1350	403.8391	313.8944	194.4603	104.4581			68.8928 (83)
Total gains	427.8272	505.9402	599.5783	703.4156	772.0953	764.0806	727.7291	667.0960	587.3347	487.9925	421.0612			402.7039 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	47.4177	47.5420	47.6644	48.2481	48.3589	48.8815	48.8815	48.9795	48.6789	48.3589	48.1353	47.9037
alpha	4.1612	4.1695	4.1776	4.2165	4.2239	4.2588	4.2588	4.2653	4.2453	4.2239	4.2090	4.1936
util living area	0.9960	0.9914	0.9773	0.9318	0.8278	0.6611	0.5054	0.5657	0.8163	0.9649	0.9925	0.9969 (86)
MIT	19.4510	19.6441	19.9795	20.4095	20.7476	20.9309	20.9827	20.9726	20.8260	20.3592	19.8257	19.4200 (87)
Th 2	19.8666	19.8692	19.8718	19.8838	19.8861	19.8966	19.8966	19.8986	19.8926	19.8861	19.8815	19.8767 (88)
util rest of house	0.9948	0.9888	0.9703	0.9102	0.7755	0.5691	0.3863	0.4430	0.7408	0.9496	0.9898	0.9959 (89)
MIT 2	17.8126	18.0954	18.5821	19.1961	19.6386	19.8491	19.8897	19.8864	19.7489	19.1406	18.3699	17.7742 (90)
Living area fraction	FLA = Living area / (4) =											0.2085 (91)
MIT	18.1543	18.4184	18.8735	19.4491	19.8699	20.0747	20.1177	20.1129	19.9735	19.3947	18.6735	18.1174 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.0043	18.2684	18.7235	19.2991	19.7199	19.9247	19.9677	19.9629	19.8235	19.2447	18.5235	17.9674 (93)

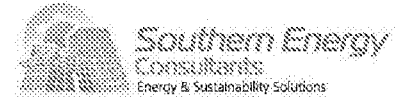
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9916	0.9833	0.9602	0.8959	0.7665	0.5716	0.3943	0.4505	0.7352	0.9373	0.9847	0.9934 (94)
Useful gains	424.2465	497.5082	575.7020	630.1725	591.7931	436.7358	286.9330	300.5531	431.8154	457.3998	414.6068	400.0445 (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	1218.4511	1185.4792	1081.1732	908.6759	699.1710	459.2422	290.4530	306.6773	495.6941	753.6437	1000.5234	1211.6431 (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	590.8883	462.3165	376.0706	200.5224	79.8892	0.0000	0.0000	0.0000	0.0000	220.4054	421.8600	603.8294 (98)
Space heating												2955.7817 (98)
Space heating per m2												(98) / (4) = 42.1292 (99)

8c. Space cooling requirement

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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													3266.0572 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	590.8883	462.3165	376.0706	200.5224	79.8892	0.0000	0.0000	0.0000	0.0000	220.4054	421.8600	603.8294	(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)	652.9152	510.8470	415.5476	221.5718	88.2753	0.0000	0.0000	0.0000	0.0000	243.5419	466.1436	667.2148	(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	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264	(64)
Efficiency of water heater (217)m	89.8088	89.7449	89.5950	89.2376	88.5394	87.3000	87.3000	87.3000	87.3000	89.2811	89.6762	87.3000	(216)
Fuel for water heating, kWh/month	174.8690	153.4774	159.6711	141.2307	137.6823	122.1389	114.8065	129.4272	130.2861	146.5084	157.3332	169.7832	(219)
Water heating fuel used													1737.2142 (219)
Annual totals kWh/year													
Space heating fuel - main system													3266.0572 (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)													318.0210 (232)
Total delivered energy for all uses													5396.2924 (238)

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

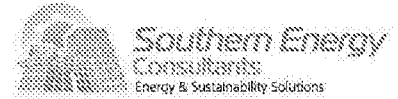
	Energy kWh/year	Emission factor kg CO ₂ /kWh	Emissions kg CO ₂ /year	
Space heating - main system 1	3266.0572	0.2160	705.4684	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1737.2142	0.2160	375.2383	(264)
Space and water heating			1080.7066	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	318.0210	0.5190	165.0529	(268)
Total CO ₂ , kg/year			1284.6845	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.3100	(273)

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

DER			18.3100	2C1
Total Floor Area		TFA	70.1600	
Assumed number of occupants		N	2.2500	
CO ₂ emission factor in Table 12 for electricity displaced from grid		EF	0.5190	
CO ₂ emissions from appliances, equation (L14)			16.6954	2C2
CO ₂ emissions from cooking, equation (L16)			2.4658	2C3
Total CO ₂ emissions			37.4712	2C4
Residual CO ₂ emissions offset from biofuel CHP			0.0000	2C5
Additional allowable electricity generation, kWh/m ² /year			0.0000	2C6
Resulting CO ₂ emissions offset from additional allowable electricity generation			0.0000	2C7
Net CO ₂ emissions			37.4712	2C8

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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	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (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) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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) =	0.3635 (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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3635	0.3907	0.4089	0.4271 (22b)
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5836	0.5912 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			12.5900	1.3258	16.6913		(27)					
Heat Loss Floor 1			35.8800	0.1300	4.6644		(28a)					
Brick Cavity	82.1100	14.6500	67.4600	0.1800	12.1428		(29a)					
External Roof 1	34.2800		34.2800	0.1300	4.4564		(30)					
Porch Roof	1.9500		1.9500	0.1300	0.2535		(30)					
Total net area of external elements Aum(A, m2)			154.2200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2684		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7822 (36)					
Total fabric heat loss						(33) + (36) =	50.0506 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 33.8582	Feb 33.6258	Mar 33.3980	Apr 32.3279	May 32.1277	Jun 31.1957	Jul 31.1957	Aug 31.0231	Sep 31.5547	Oct 32.1277	Nov 32.5327	Dec 32.9561 (38)
Heat transfer coeff	83.9088	83.6764	83.4485	82.3785	82.1783	81.2463	81.2463	81.0737	81.6053	82.1783	82.5833	83.0067 (39)
Average = Sum(39)m / 12 =												82.3775 (39)
HLP	Jan 1.1960	Feb 1.1927	Mar 1.1894	Apr 1.1742	May 1.1713	Jun 1.1580	Jul 1.1580	Aug 1.1556	Sep 1.1631	Oct 1.1713	Nov 1.1771	Dec 1.1831 (40)
HLP (average)												1.1741 (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												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)
Daily hot water use	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy conte	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)
Energy content (annual)										Total = Sum(45)m =		1378.8803 (45)
Distribution loss (46)m = 0.15 x (45)m	21.4441	18.7551	19.3536	16.8729	16.1900	13.9707	12.9459	14.8556	15.0331	17.5196	19.1240	20.7674 (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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	49.1251	42.7575	45.5523	42.3542	41.9796	38.8967	40.1932	41.9796	42.3542	45.5523	45.8116	49.1251 (61)
Total heat required for water heating calculated for each month	192.0854	167.7916	174.5763	154.8404	149.9128	132.0348	126.4994	141.0172	142.5746	162.3496	173.3050	187.5746 (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	192.0854	167.7916	174.5763	154.8404	149.9128	132.0348	126.4994	141.0172	142.5746	162.3496	173.3050	187.5746 (64)
Heat gains from water heating, kWh/month	59.8156	52.2632	54.2885	47.9902	46.3827	40.6926	38.7451	43.4249	43.9118	50.2232	53.8444	58.3157 (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	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0077	15.9942	13.0074	9.8474	7.3611	6.2145	6.7150	8.7284	11.7153	14.8752	17.3616	18.5082 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.6702	199.7214	194.5525	183.5484	169.6577	156.6024	147.8807	145.8295	150.9984	162.0025	175.6932	188.9485 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500 (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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001 (71)
Water heating gains (Table 5)	80.3973	77.7726	72.9685	66.6531	62.3423	56.5175	52.0768	58.3668	60.9887	67.5043	74.7839	78.3814 (72)
Total internal gains	355.8252	353.2383	340.2784	319.7989	299.1111	279.0845	266.4225	272.6747	283.4524	304.1321	327.7888	345.5880 (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
East			7.7400			19.6403	0.6300		0.7000		0.7700	46.4580 (76)
West			4.8500			19.6403	0.6300		0.7000		0.7700	29.1113 (80)
Solar gains	75.5692	147.8294	243.4540	355.0631	435.1432	445.4465	424.0832	364.2812	283.1470	175.4120	94.2259	62.1444 (83)
Total gains	431.3944	501.0677	583.7323	674.8620	734.2543	724.5309	690.5057	636.9559	566.5994	479.5441	422.0147	407.7325 (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	58.0657	58.2270	58.3859	59.1444	59.2884	59.9686	59.9686	60.0962	59.7048	59.2884	58.9977	58.6967
alpha	4.8710	4.8818	4.8924	4.9430	4.9526	4.9979	4.9979	5.0064	4.9803	4.9526	4.9332	4.9131
util living area	0.9978	0.9950	0.9852	0.9479	0.8482	0.6730	0.5082	0.5682	0.8302	0.9741	0.9954	0.9983 (86)
MIT	19.7112	19.8728	20.1561	20.5241	20.8114	20.9567	20.9912	20.9852	20.8762	20.4832	20.0305	19.6861 (87)
Th 2	19.9232	19.9259	19.9285	19.9407	19.9430	19.9537	19.9537	19.9557	19.9496	19.9430	19.9384	19.9335 (88)
util rest of house	0.9970	0.9932	0.9799	0.9289	0.7968	0.5807	0.3923	0.4479	0.7544	0.9612	0.9936	0.9977 (89)
MIT 2	18.2107	18.4480	18.8606	19.3890	19.7627	19.9259	19.9506	19.9498	19.8519	19.3437	18.6880	18.1812 (90)
Living area fraction	18.5236	18.7451	19.1307	19.6257	19.9814	20.1408	20.1676	20.1657	20.0655	19.5813	18.9679	18.4950 (92)
Temperature adjustment	18.5236	18.7451	19.1307	19.6257	19.9814	20.1408	20.1676	20.1657	20.0655	19.5813	18.9679	18.4950 (93)

8. Space heating requirement

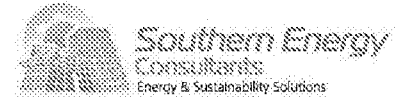
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Useful gains	429.4515	496.2813	568.8134	622.1575	586.6016	433.4042	287.6478	301.2505	432.8505	458.0425	418.2264	406.3231 (95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000 (96)
Heat loss rate W	1193.4812	1158.5101	1054.0148	883.5688	680.5476	450.1704	289.8560	305.3022	486.8174	738.0694	980.0915	1186.5816 (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	568.4381	445.0178	360.9898	188.2161	69.8958	0.0000	0.0000	0.0000	0.0000	208.3400	404.5429	580.5123 (98)
Space heating												2825.9529 (98)
Space heating per m ²												(98) / (4) = 40.2787 (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													3025.6455 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	568.4381	445.0178	360.9898	188.2161	69.8958	0.0000	0.0000	0.0000	0.0000	208.3400	404.5429	580.5123	(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)	608.6061	476.4644	386.4987	201.5162	74.8349	0.0000	0.0000	0.0000	0.0000	223.0622	433.1294	621.5335	(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	192.0854	167.7916	174.5763	154.8404	149.9128	132.0348	126.4994	141.0172	142.5746	162.3496	173.3050	187.5746	(64)
Efficiency of water heater (217)m	87.6166	87.3904	86.8396	85.5436	83.2579	80.3000	80.3000	80.3000	80.3000	85.6802	87.1138	87.7060	(216)
Fuel for water heating, kWh/month	219.2341	192.0024	201.0330	181.0075	180.0583	164.4269	157.5335	175.6130	177.5524	189.4833	198.9408	213.8674	(219)
Water heating fuel used													2250.7526 (219)
Annual totals kWh/year													
Space heating fuel - main system													3025.6455 (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)													318.0210 (232)
Total delivered energy for all uses													5669.4191 (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	3025.6455	0.2160	653.5394 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2250.7526	0.2160	486.1626 (264)
Space and water heating			1139.7020 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	318.0210	0.5190	165.0529 (268)
Total CO2, kg/m2/year			1343.6799 (272)
Emissions per m2 for space and water heating			16.2443 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.3525 (272b)
Emissions per m2 for pumps and fans			0.5548 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.2443 * 1.00) + 2.3525 + 0.5548, rounded to 2 d.p.			19.1500 (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	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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)	=	0.3635 (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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3635	0.3907	0.4089	0.4271 (22b)
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5836	0.5912 (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			2.0600	1.4000	2.8840		(26)
Opening Type 2 (Uw = 1.30)			12.5900	1.2357	15.5580		(27)
Heat Loss Floor 1			35.8800	0.1900	6.8172	75.0000	2691.0000 (28a)
Brick Cavity	82.1100	14.6500	67.4600	0.2500	16.8650	60.0000	4047.6000 (29a)
External Roof 1	34.2800		34.2800	0.1100	3.7708	9.0000	308.5200 (30)
Porch Roof	1.9500		1.9500	0.1100	0.2145	9.0000	17.5500 (30)
Total net area of external elements Aum (A, m ²)			154.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.1095		(33)
Party Wall 1			37.5200	0.0000	0.0000	110.0000	4127.2000 (32)
Internal Wall 1			126.7100			9.0000	1140.3900 (32c)
Internal Wall 2			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			34.2800			18.0000	617.0400 (32d)
Internal Ceiling 1			34.2800			9.0000	308.5200 (32e)
Heat capacity Cm = Sum (A x k)			(28)...(30) + (32) + (32a)...(32e) =				14868.8200 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							211.9273 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9427 (36)
Total fabric heat loss						(33) + (36) =	55.0522 (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	33.8582	33.6258	33.3980	32.3279	32.1277	31.1957	31.1957	31.0231	31.5547	32.1277	32.5327	32.9561 (38)
Heat transfer coeff	88.9104	88.6780	88.4502	87.3801	87.1799	86.2479	86.2479	86.0753	86.6069	87.1799	87.5849	88.0083 (39)
Average = Sum(39)m / 12 =												87.3791 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2673	1.2639	1.2607	1.2454	1.2426	1.2293	1.2293	1.2268	1.2344	1.2426	1.2484	1.2544 (40)
HLP (average)												1.2454 (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												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy conte	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1378.8803 (45)											
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (46)
Water storage loss:												
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (59)
Heat gains from water heating, kWh/month	30.3791	26.5697	27.4176	23.9033	22.9358	19.7919	18.3401	21.0455	21.2968	24.8194	27.0923	29.4205 (65)

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

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	(66)
(66)m	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0077	15.9942	13.0074	9.8474	7.3611	6.2145	6.7150	8.7284	11.7153	14.8752	17.3616	18.5082	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.6702	199.7214	194.5525	183.5484	169.6577	156.6024	147.8807	145.8295	150.9984	162.0025	175.8932	188.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	(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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	(71)
Water heating gains (Table 5)	40.8321	39.5383	36.8516	33.1991	30.8277	27.4887	24.6506	28.2870	29.5789	33.3594	37.6282	39.5437	(72)
Total internal gains	313.2600	312.0040	301.1615	283.3449	264.5965	247.0557	235.9963	239.5949	249.0427	266.9872	287.6331	303.7504	(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	
East					7.7400	19.6403	0.4400	0.0000	0.7700		51.5029 (76)	
West					4.8500	19.6403	0.4400	0.0000	0.7700		32.2725 (80)	
Solar gains	83.7754	163.8824	269.8910	393.6200	482.3960	493.8182	470.1350	403.8391	313.8944	194.4603	104.4581	68.8928 (83)
Total gains	397.0354	475.8864	571.0525	676.9649	746.9925	740.8738	706.1314	643.4339	562.9371	461.4475	392.0911	372.6432 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	46.4538	46.5756	46.6955	47.2674	47.3759	47.8879	47.8879	47.9839	47.6894	47.3759	47.1568	46.9300	
alpha	4.0969	4.1050	4.1130	4.1512	4.1584	4.1925	4.1925	4.1989	4.1793	4.1584	4.1438	4.1287	
util living area	0.9967	0.9926	0.9798	0.9372	0.8377	0.6744	0.5183	0.5819	0.8302	0.9695	0.9938	0.9975	(86)
MIT	19.3819	19.5797	19.9244	20.3689	20.7237	20.9217	20.9797	20.9677	20.8052	20.3142	19.7654	19.3512	(87)
Th 2	19.8666	19.8692	19.8718	19.8838	19.8861	19.8966	19.8966	19.8986	19.8926	19.8861	19.8815	19.8767	(88)
util rest of house	0.9957	0.9904	0.9735	0.9171	0.7873	0.5827	0.3973	0.4575	0.7578	0.9561	0.9916	0.9967	(89)
MIT 2	18.3976	18.5964	18.9392	19.3780	19.6986	19.8590	19.8910	19.8885	19.7803	19.3360	18.7917	18.3748	(90)
Living area fraction	fLA = Living area / (4) =												0.2085 (91)
MIT	18.6029	18.8014	19.1446	19.5847	19.9124	20.0806	20.1180	20.1135	19.9940	19.5400	18.9948	18.5784	(92)
Temperature adjustment													0.0000
adjusted MIT	18.6029	18.8014	19.1446	19.5847	19.9124	20.0806	20.1180	20.1135	19.9940	19.5400	18.9948	18.5784	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9941	0.9876	0.9681	0.9105	0.7887	0.5992	0.4225	0.4832	0.7655	0.9506	0.9891	0.9955	(94)
Ext temp.	394.7113	469.9692	552.8625	616.3981	589.1262	443.8969	298.3434	310.8893	430.9517	438.6318	387.8001	370.9506	(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	1271.6745	1232.7507	1118.4202	933.6260	715.9540	472.6920	303.4203	319.6435	510.4628	779.3860	1041.8024	1265.4206	(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 m2	652.4606	512.5892	420.7749	228.4041	94.3598	0.0000	0.0000	0.0000	0.0000	253.5212	470.8817	665.4856	(98)
	(98) / (4) =												47.0136 (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	810.7302	638.2344	654.1723	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8654	0.9192	0.8921	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014											
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	701.6435	586.6333	583.5655	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	949.7001	907.4141	835.5337	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 (103a)
Space cooling kWh											
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	178.6007	238.6610	187.4643	0.0000	0.0000	0.0000 (104)
Cooled fraction									fc = cooled area / (4) =		604.7260 (104)
Intermittency factor (Table 10b)											1.0000 (105)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	44.6502	59.6652	46.8661	0.0000	0.0000	0.0000 (107)
Space cooling per m2											151.1815 (107)
Energy for space heating											2.1548 (108)
Energy for space cooling											47.0136 (99)
Total											2.1548 (108)
Dwelling Fabric Energy Efficiency (DFEE)											49.1685 (109)
											49.2 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (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) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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) = 0.3635 (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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3635	0.3907	0.4089	0.4271 (22b)
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5836	0.5912 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.0600	1.0000	2.0600		(26)					
TER Opening Type (Uw = 1.40)			12.5900	1.3258	16.6913		(27)					
Heat Loss Floor 1			35.8800	0.1300	4.6644		(28a)					
Brick Cavity	82.1100	14.6500	67.4600	0.1800	12.1428		(29a)					
External Roof 1	34.2800		34.2800	0.1300	4.4564		(30)					
Porch Roof	1.9500		1.9500	0.1300	0.2535		(30)					
Total net area of external elements Aum(A, m2)			154.2200				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	40.2684		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.7822 (36)					
Total fabric heat loss							(33) + (36) = 50.0506 (37)					
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat transfer coeff	33.8582	33.6258	33.3980	32.3279	32.1277	31.1957	31.1957	31.0231	31.5547	32.1277	32.5327	32.9561 (38)
Average = Sum(39)m / 12 =	83.9088	83.6764	83.4485	82.3785	82.1783	81.2463	81.2463	81.0737	81.6053	82.1783	82.5833	83.0067 (39)
												82.3775 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1960	1.1927	1.1894	1.1742	1.1713	1.1580	1.1580	1.1556	1.1631	1.1713	1.1771	1.1831 (40)
Days in month												1.1741 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy content (annual)	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1378.8803 (45)
Water 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 (46)
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)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (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	30.3791	26.5697	27.4176	23.9033	22.9358	19.7919	18.3401	21.0455	21.2968	24.8194	27.0923	29.4205 (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	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	112.5002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	18.0077	15.9942	13.0074	9.8474	7.3611	6.2145	6.7150	8.7284	11.7153	14.8752	17.3616	18.5082	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	197.6702	199.7214	194.5525	183.5484	169.6577	156.6024	147.8807	145.8295	150.9984	162.0025	175.8932	188.9485	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	34.2500	(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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	(71)
Water heating gains (Table 5)	40.8321	39.5383	36.8516	33.1991	30.8277	27.4887	24.6506	28.2870	29.5789	33.3594	37.6282	39.5437	(72)
Total internal gains	313.2600	312.0040	301.1615	283.3449	264.5965	247.0557	235.9963	239.5949	249.0427	266.9872	287.6331	303.7504	(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			
East												7.7400	19.6403		0.6300		0.7000		0.7700		46.4580 (76)	
West												4.8500	19.6403		0.6300		0.7000		0.7700		29.1113 (80)	
Solar gains	75.5692	147.8294	243.4540	355.0631	435.1432	445.4465	424.0832	364.2812	283.1470	175.4120	94.2259	62.1444	(83)									
Total gains	388.8292	459.8334	544.6155	638.4080	699.7396	692.5021	660.0795	603.8761	532.1897	442.3993	381.8590	365.8948	(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	58.0657	58.2270	58.3859	59.1444	59.2884	59.9686	59.9686	60.0962	59.7048	59.2884	58.9977	58.6967	
alpha	4.8710	4.8818	4.8924	4.9430	4.9526	4.9979	4.9979	5.0064	4.9803	4.9526	4.9332	4.9131	
util living area	0.9986	0.9965	0.9888	0.9572	0.8665	0.6964	0.5297	0.5952	0.8554	0.9811	0.9971	0.9990 (86)	
MIT	19.6553	19.8192	20.1076	20.4860	20.7894	20.9496	20.9895	20.9819	20.8560	20.4392	19.9781	19.6308 (87)	
Th 2	19.9232	19.9259	19.9285	19.9407	19.9430	19.9537	19.9537	19.9557	19.9496	19.9430	19.9384	19.9335 (88)	
util rest of house	0.9981	0.9953	0.9847	0.9410	0.8182	0.6038	0.4099	0.4711	0.7845	0.9713	0.9958	0.9986 (89)	
MIT 2	18.6982	18.8637	19.1519	19.5292	19.8032	19.9312	19.9512	19.9507	19.8697	19.4922	19.0327	18.6820 (90)	
Living area fraction									fLA = Living area / (4) =			0.2085 (91)	
MIT	18.8978	19.0630	19.3512	19.7287	20.0089	20.1436	20.1677	20.1657	20.0753	19.6897	19.2298	18.8799 (92)	
Temperature adjustment												0.0000	
adjusted MIT	18.8978	19.0630	19.3512	19.7287	20.0089	20.1436	20.1677	20.1657	20.0753	19.6897	19.2298	18.8799 (93)	

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9974	0.9940	0.9818	0.9370	0.8217	0.6217	0.4351	0.4972	0.7944	0.9681	0.9947	0.9981 (94)
Useful gains	387.8361	457.0548	534.6938	598.1622	574.9431	430.5487	287.1820	300.2533	422.7610	428.3001	379.8236	365.2004 (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	1224.8803	1185.1073	1072.4140	892.0525	682.8070	450.3932	289.8605	305.3013	487.6191	746.9731	1001.7189	1218.5264 (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	622.7609	489.2512	400.0638	211.6010	80.2508	0.0000	0.0000	0.0000	0.0000	237.0927	447.7646	634.8746 (98)
Space heating												3123.6596 (98)
Space heating per m2										(98) / (4) =		44.5219 (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	763.7150	601.2224	616.1600	0.0000	0.0000	0.0000	0.0000 (100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8912	0.9416	0.9180	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	680.6140	566.0930	565.6179	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	893.1617	853.5873	789.2972	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	0.0000	153.0344	213.8958	166.4174	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												533.3476 (104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Cooled fraction	FC = cooled area / (4) =										1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	38.2586	53.4739	41.6044	0.0000	0.0000	0.0000 (107)
Space cooling											133.3369 (107)
Space cooling per m2											1.9005 (108)
Energy for space heating											44.5219 (99)
Energy for space cooling											1.9005 (108)
Total											46.4224 (109)
Target Fabric Energy Efficiency (TFEE)											53.4 (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	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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)	=	0.3635 (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	0.3816	0.3635	0.3635	0.3362	0.3362	0.2998	0.3089	0.2908	0.2998	0.3180	0.3180	0.3453 (22b)
Effective ac	0.5728	0.5660	0.5660	0.5565	0.5565	0.5450	0.5477	0.5423	0.5450	0.5506	0.5506	0.5596 (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			2.0600	1.4000	2.8840		(26)
Opening Type 2 (Uw = 1.30)			12.5900	1.2357	15.5580		(27)
Heat Loss Floor 1			35.8800	0.1900	6.8172	75.0000	2691.0000 (28a)
Brick Cavity	82.1100	14.6500	67.4600	0.2500	16.8650	60.0000	4047.6000 (29a)
External Roof 1	34.2800		34.2800	0.1100	3.7708	9.0000	308.5200 (30)
Porch Roof	1.9500		1.9500	0.1100	0.2145	9.0000	17.5500 (30)
Total net area of external elements Aum (A, m ²)			154.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.1095			(33)
Party Wall 1			37.5200	0.0000	0.0000	110.0000	4127.2000 (32)
Internal Wall 1			126.7100			9.0000	1140.3900 (32c)
Internal Wall 2			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			34.2800			18.0000	617.0400 (32d)
Internal Ceiling 1			34.2800			18.0000	617.0400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				15177.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3247 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9427 (36)
Total fabric heat loss			(33) + (36) =				55.0522 (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	31.9321	31.5547	31.5547	31.0231	31.0231	30.3788	30.5329	30.2292	30.3788	30.6917	30.6917	31.1957 (38)
Heat transfer coeff	86.9843	86.6069	86.6069	86.0753	86.0753	85.4310	85.5851	85.2814	85.4310	85.7439	85.7439	86.2479 (39)
Average = Sum(39)m / 12 =												85.9844 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2398	1.2344	1.2344	1.2268	1.2268	1.2177	1.2199	1.2155	1.2177	1.2221	1.2221	1.2293 (40)
HLP (average)												1.2255 (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												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy conte	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF HEAT DEMAND 09 Jan 2014

Energy content (annual)	Total = Sum(45)m = 1378.8803 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.4441	18.7551	19.3536	16.8729	16.1900	13.9707	12.9459	14.8556	15.0331	17.5196	19.1240	20.7674 (46)
Water storage loss:											
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (56)
If cylinder contains dedicated solar storage	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (57)
Combi loss	14.0873	12.7040	14.0334	13.5447	13.9700	13.4891	13.9199	13.9524	13.5194	14.0071	13.5970 (61)
Total heat required for water heating calculated for each month	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =											0.0000 (63)
Output from w/h	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904 (64)
RHI water heating demand											1543.7815 (64)
Heat gains from water heating, kWh/month	51.0562	44.7498	46.4088	40.7878	39.3803	34.3407	32.1768	36.4181	36.7031	42.3369	45.7908 (65)
											1544 (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	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.0192	39.9856	32.5185	24.6186	18.4027	15.5363	16.7875	21.8211	29.2882	37.1881	43.4040	46.2704	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.0302	298.0916	290.3768	273.9528	253.2204	233.7349	220.7174	217.6559	225.3708	241.7948	262.5271	282.0126	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	(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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	(71)
Water heating gains (Table 5)	68.6239	66.5920	62.3774	56.6498	52.9305	47.6954	43.2484	48.9491	50.9766	56.9044	63.5983	66.6044	(72)
Total internal gains	507.4233	503.4194	484.0228	453.9712	423.3037	395.7167	379.5034	387.1761	404.3856	434.6374	468.2796	493.6375	(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
East						7.7400	22.3313	0.4400	0.0000	0.7700		58.5597
West						4.8500	22.3313	0.4400	0.0000	0.7700		36.6944 (80)

Solar gains	95.2540	167.6133	272.1744	407.9114	486.0436	532.0636	501.2255	440.9596	342.7416	212.2430	121.6754	77.5722 (83)
Total gains	602.6773	671.0327	756.1972	861.8826	909.3473	927.7804	880.7289	828.1357	747.1272	646.8804	589.9549	571.2098 (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	48.4677	48.6789	48.6789	48.9795	48.9795	49.3489	49.2600	49.4355	49.3489	49.1688	49.1688	48.8815
alpha	4.2312	4.2453	4.2453	4.2653	4.2653	4.2899	4.2840	4.2957	4.2899	4.2779	4.2779	4.2588
util living area	0.9830	0.9723	0.9395	0.8493	0.6842	0.4513	0.3000	0.3277	0.6199	0.8878	0.9679	0.9859 (86)
MIT	19.8368	19.9966	20.3116	20.6705	20.9020	20.9876	20.9984	20.9977	20.9522	20.6579	20.1974	19.8085 (87)
Th 2	19.8883	19.8926	19.8926	19.8986	19.8986	19.9059	19.9041	19.9076	19.9059	19.9023	19.9023	19.8966 (88)
util rest of house	0.9781	0.9645	0.9223	0.8095	0.6118	0.3568	0.1946	0.2168	0.5200	0.8472	0.9572	0.9817 (89)
MIT 2	18.3867	18.6186	19.0632	19.5466	19.8177	19.9001	19.9039	19.9072	19.8766	19.5480	18.9166	18.3518 (90)
Living area fraction	18.6891	18.9059	19.3235	19.7809	20.0438	20.1269	20.1321	20.1346	20.1009	19.7795	19.1836	18.6556 (92)
MIT	18.5391	18.7559	19.1735	19.6309	19.8938	19.9769	19.9821	19.9846	19.9509	19.6295	19.0336	18.5056 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9697	0.9537	0.9082	0.7983	0.6115	0.3631	0.2022	0.2247	0.5244	0.8349	0.9456	0.9743 (94)
Useful gains	584.4089	639.9558	686.8061	688.0592	556.0649	336.8405	178.0463	186.0650	391.7892	540.0780	557.8513	556.5037 (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	1168.9879	1139.3950	1019.6692	837.5917	593.3886	339.7486	178.1976	186.3030	405.8757	688.4787	946.0673	1156.2027 (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	434.9268	335.6231	247.6501	107.6634	27.7688	0.0000	0.0000	0.0000	0.0000	110.4101	279.5155	446.1761 (98)
Space heating												1989.7339 (98)
RHI space heating demand												1990 (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	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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) =	0.3635 (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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3635	0.3907	0.4089	0.4271 (22b)
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5836	0.5912 (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			2.0600	1.4000	2.8840		(26)
Opening Type 2 (Uw = 1.30)			12.5900	1.2357	15.5580		(27)
Heat Loss Floor 1			35.8800	0.1900	6.8172	75.0000	2691.0000 (28a)
Brick Cavity	82.1100	14.6500	67.4600	0.2500	16.8650	60.0000	4047.6000 (29a)
External Roof 1	34.2800		34.2800	0.1100	3.7708	9.0000	308.5200 (30)
Porch Roof	1.9500		1.9500	0.1100	0.2145	9.0000	17.5500 (30)
Total net area of external elements Aum (A, m ²)			154.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1095		(33)
Party Wall 1			37.5200	0.0000	0.0000	110.0000	4127.2000 (32)
Internal Wall 1			126.7100			9.0000	1140.3900 (32c)
Internal Wall 2			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			34.2800			18.0000	617.0400 (32d)
Internal Ceiling 1			34.2800			18.0000	617.0400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15177.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3247 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9427 (36)
Total fabric heat loss						(33) + (36) =	55.0522 (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	33.8582	33.6258	33.3980	32.3279	32.1277	31.1957	31.1957	31.0231	31.5547	32.1277	32.5327	32.9561 (38)
Heat transfer coeff	88.9104	88.6780	88.4502	87.3801	87.1799	86.2479	86.2479	86.0753	86.6069	87.1799	87.5849	88.0083 (39)
Average = Sum(39)m / 12 =												87.3791 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2673	1.2639	1.2607	1.2454	1.2426	1.2293	1.2293	1.2268	1.2344	1.2426	1.2484	1.2544 (40)
HLP (average)												1.2454 (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												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy conte	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1378.8803 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.4441	18.7551	19.3536	16.8729	16.1900	13.9707	12.9459	14.8556	15.0331	17.5196	19.1240	20.7674	(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	14.0873	12.7040	14.0334	13.5447	13.9700	13.4891	13.9199	13.9524	13.5194	14.0071	13.5970	14.0769	(61)
Total heat required for water heating calculated for each month	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
Solar input (sum of months) = Sum(63)m =												0.0000	(63)
Output from w/h	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264	(64)
Heat gains from water heating, kWh/month	51.0562	44.7498	46.4088	40.7878	39.3803	34.3407	32.1768	36.4181	36.7031	42.3369	45.7908	49.5537	(65)
Total per year (kWh/year) = Sum(64)m =												1543.7815	(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	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.0192	39.9856	32.5185	24.6186	18.4027	15.5363	16.7875	21.8211	29.2882	37.1881	43.4040	46.2704	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.0302	298.0916	290.3768	273.9528	253.2204	233.7349	220.7174	217.6559	225.3708	241.7948	262.5271	282.0126	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	(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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	(71)
Water heating gains (Table 5)	68.6239	66.5920	62.3774	56.6498	52.9305	47.6954	43.2484	48.9491	50.9766	56.9044	63.5983	66.6044	(72)
Total internal gains	507.4233	503.4194	484.0228	453.9712	423.3037	395.7167	379.5034	387.1761	404.3856	434.6374	468.2796	493.6375	(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
East					7.7400	19.6403	0.4400	0.0000			0.7700			51.5029 (76)
West					4.8500	19.6403	0.4400	0.0000			0.7700			32.2725 (80)

Solar gains	83.7754	163.8824	269.8910	393.6200	482.3960	493.8182	470.1350	403.8391	313.8944	194.4603	104.4581	68.8928 (83)		
Total gains	591.1987	667.3018	753.9138	847.5912	905.6997	889.5349	849.6384	791.0152	718.2801	629.0977	572.7376	562.5303 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	47.4177	47.5420	47.6644	48.2481	48.3589	48.8815	48.8815	48.9795	48.6789	48.3589	48.1353	47.9037	
alpha	4.1612	4.1695	4.1776	4.2165	4.2239	4.2588	4.2588	4.2653	4.2453	4.2239	4.2090	4.1936	
util living area	0.9868	0.9772	0.9522	0.8859	0.7614	0.5869	0.4385	0.4871	0.7285	0.9232	0.9774	0.9892	(86)
MIT	19.6811	19.8644	20.1272	20.5497	20.8218	20.9559	20.9899	20.9844	20.8906	20.5209	20.0341	19.6474	(87)
Th 2	19.8666	19.8692	19.8718	19.8838	19.8861	19.8966	19.8966	19.8986	19.8926	19.8861	19.8815	19.8767	(88)
util rest of house	0.9832	0.9709	0.9388	0.8550	0.7022	0.4985	0.3325	0.3768	0.6443	0.8951	0.9700	0.9861	(89)
MIT 2	18.1462	18.4119	18.8526	19.3778	19.7188	19.8677	19.8928	19.8920	19.8087	19.3553	18.6685	18.1043	(90)
Living area fraction	18.4663	18.7148	19.1279	19.6221	19.9488	20.0946	20.1215	20.1198	20.0343	19.5983	18.9532	18.4261	(91)
MIT	18.3163	18.5648	18.9779	19.4721	19.7988	19.9446	19.9715	19.9698	19.8843	19.4483	18.8032	18.2761	(93)
Temperature adjustment												-0.1500	
adjusted MIT												18.2761	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9759	0.9609	0.9251	0.8414	0.6971	0.5025	0.3399	0.3842	0.6436	0.8810	0.9600	0.9797	(94)
Useful gains	576.9382	641.1847	697.4494	713.1700	631.3465	447.0109	288.7916	303.9173	462.2877	554.2646	549.8213	551.1352	(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	1246.1923	1211.7682	1103.6682	923.7947	706.0528	460.9605	290.7871	307.2696	500.9588	771.3975	1025.0280	1238.8097	(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	497.9250	383.4321	302.2268	151.6498	55.5815	0.0000	0.0000	0.0000	0.0000	161.5469	342.1488	511.6298	(98)
Space heating												2406.1409	(98)
Space heating per m ²												(98) / (4) =	34.2951 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Energy Ratings 09 Jan 2014

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												2658.7192 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	497.9250	383.4321	302.2268	151.6498	55.5815	0.0000	0.0000	0.0000	0.0000	161.5469	342.1488	511.6298 (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)	550.1934	423.6819	333.9523	167.5689	61.4161	0.0000	0.0000	0.0000	0.0000	178.5049	378.0650	565.3368 (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	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264 (64)
Efficiency of water heater (217)m	89.7115	89.6317	89.4467	89.0190	88.2775	87.3000	87.3000	87.3000	87.3000	89.0397	89.5417	87.3000 (216)
Fuel for water heating, kWh/month	175.0586	153.6712	159.9359	141.5775	138.0908	122.1389	114.8065	129.4272	130.2861	146.9057	157.5694	169.9562 (219)
Water heating fuel used												1739.4241 (219)
Annual totals kWh/year												
Space heating fuel - main system												2658.7192 (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)												318.0210 (232)
Total delivered energy for all uses												4791.1644 (238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2658.7192	3.4800	92.5234 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1739.4241	3.4800	60.5320 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	318.0210	13.1900	41.9470 (250)
Additional standing charges			120.0000 (251)
Total energy cost			324.8949 (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] =	
SAP value	83.4703	
SAP rating (Section 12)	83 (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	2658.7192	0.2160	574.2834 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1739.4241	0.2160	375.7156 (264)
Space and water heating			949.9990 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	318.0210	0.5190	165.0529 (268)
Total kg/year			1153.9769 (272)
CO2 emissions per m2			16.4500 (273)
EI value			86.5723
EI rating			87 (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	$3.48 / 0.8863 = 3.926$, stars = 4
Water heating environmental impact	$0.216 / 0.8863 = 0.2437$, stars = 4

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

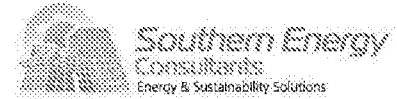
Calculation Type: New Build (As Designed)



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	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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) =		0.3635 (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	0.3816	0.3635	0.3635	0.3362	0.3362	0.2998	0.3089	0.2908	0.2998	0.3180	0.3180	0.3453 (22b)
Effective ac	0.5728	0.5660	0.5660	0.5565	0.5565	0.5450	0.5477	0.5423	0.5450	0.5506	0.5506	0.5596 (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			2.0600	1.4000	2.8840		(26)
Opening Type 2 (Uw = 1.30)			12.5900	1.2357	15.5580		(27)
Heat Loss Floor 1			35.8800	0.1900	6.8172	75.0000	2691.0000 (28a)
Brick Cavity	82.1100	14.6500	67.4600	0.2500	16.8650	60.0000	4047.6000 (29a)
External Roof 1	34.2800		34.2800	0.1100	3.7708	9.0000	308.5200 (30)
Porch Roof	1.9500		1.9500	0.1100	0.2145	9.0000	17.5500 (30)
Total net area of external elements Aum (A, m ²)			154.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.1095		(33)
Party Wall 1			37.5200	0.0000	0.0000	110.0000	4127.2000 (32)
Internal Wall 1			126.7100			9.0000	1140.3900 (32c)
Internal Wall 2			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			34.2800			18.0000	617.0400 (32d)
Internal Ceiling 1			34.2800			18.0000	617.0400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				15177.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3247 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9427 (36)
Total fabric heat loss						(33) + (36) =	55.0522 (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	31.9321	31.5547	31.5547	31.0231	31.0231	30.3788	30.5329	30.2292	30.3788	30.6917	30.6917	31.1957 (38)
Heat transfer coeff	86.9843	86.6069	86.6069	86.0753	86.0753	85.4310	85.5851	85.2814	85.4310	85.7439	85.7439	86.2479 (39)
Average = Sum(39)m / 12 =												85.9844 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2398	1.2344	1.2344	1.2268	1.2268	1.2177	1.2199	1.2155	1.2177	1.2221	1.2221	1.2293 (40)
HLP (average)												1.2255 (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												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy conte	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)	Total = Sum(45)m = 1378.8803 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.4441	18.7551	19.3536	16.8729	16.1900	13.9707	12.9459	14.8556	15.0331	17.5196	19.1240	20.7674 (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	14.0873	12.7040	14.0334	13.5447	13.9700	13.4891	13.9199	13.9524	13.5194	14.0071	13.5970 (61)
Total heat required for water heating calculated for each month											
157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
Solar input (sum of months) = Sum(63)m =	0.0000 (63)										
Output from w/h											
157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264 (64)
Heat gains from water heating, kWh/month											
51.0562	44.7498	46.4088	40.7878	39.3803	34.3407	32.1768	36.4181	36.7031	42.3369	45.7908	49.5537 (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	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.0192	39.9856	32.5185	24.6186	18.4027	15.5363	16.7875	21.8211	29.2882	37.1881	43.4040	46.2704	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.0302	298.0916	290.3768	273.9528	253.2204	233.7349	220.7174	217.6559	225.3708	241.7948	262.5271	282.0126	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	(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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	(71)
Water heating gains (Table 5)	68.6239	66.5920	62.3774	56.6498	52.9305	47.6954	43.2484	48.9491	50.9766	56.9044	63.5983	66.6044	(72)
Total internal gains	507.4233	503.4194	484.0228	453.9712	423.3037	395.7167	379.5034	387.1761	404.3856	434.6374	468.2796	493.6375	(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
East						7.7400	22.3313	0.4400	0.0000			0.7700	58.5597 (76)
West						4.8500	22.3313	0.4400	0.0000			0.7700	36.6944 (80)
Solar gains	95.2540	167.6133	272.1744	407.9114	486.0436	532.0636	501.2255	440.9596	342.7416	212.2430	121.6754	77.5722	(83)
Total gains	602.6773	671.0327	756.1972	861.8826	909.3473	927.7804	880.7289	828.1357	747.1272	646.8804	589.9549	571.2098	(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	48.4677	48.6789	48.6789	48.9795	48.9795	49.3489	49.2600	49.4355	49.3489	49.1688	49.1688	48.8815
alpha	4.2312	4.2453	4.2453	4.2653	4.2653	4.2899	4.2840	4.2957	4.2899	4.2779	4.2779	4.2588
util living area	0.9830	0.9723	0.9395	0.8493	0.6842	0.4513	0.3000	0.3277	0.6199	0.8878	0.9679	0.9859 (86)
MIT	19.8368	19.9966	20.3116	20.6705	20.9020	20.9876	20.9984	20.9977	20.9522	20.6579	20.1974	19.8085 (87)
Th 2	19.8883	19.8926	19.8926	19.8986	19.8986	19.9059	19.9041	19.9076	19.9059	19.9023	19.9023	19.8966 (88)
util rest of house	0.9781	0.9645	0.9223	0.8095	0.6118	0.3568	0.1946	0.2168	0.5200	0.8472	0.9572	0.9817 (89)
MIT 2	18.3867	18.6186	19.0632	19.5466	19.8177	19.9001	19.9039	19.9072	19.8766	19.5480	18.9166	18.3518 (90)
Living area fraction	18.6891	18.9059	19.3235	19.7809	20.0438	20.1269	20.1321	20.1346	20.1009	19.7795	19.1836	18.6556 (91)
MIT	18.6891	18.9059	19.3235	19.7809	20.0438	20.1269	20.1321	20.1346	20.1009	19.7795	19.1836	18.6556 (92)
Temperature adjustment	18.5391	18.7559	19.1735	19.6309	19.8938	19.9769	19.9821	19.9846	19.9509	19.6295	19.0336	-0.1500
adjusted MIT	18.5391	18.7559	19.1735	19.6309	19.8938	19.9769	19.9821	19.9846	19.9509	19.6295	19.0336	18.5056 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9697	0.9537	0.9082	0.7983	0.6115	0.3631	0.2022	0.2247	0.5244	0.8349	0.9456	0.9743 (94)
Useful gains	584.4089	639.9558	686.8061	688.0592	556.0649	336.8405	178.0463	186.0650	391.7892	540.0780	557.8513	556.5037 (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	1168.9879	1139.3950	1019.6692	837.5917	593.3886	339.7486	178.1976	186.3030	405.8757	688.4787	946.0673	1156.2027 (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	434.9268	335.6231	247.6501	107.6634	27.7688	0.0000	0.0000	0.0000	0.0000	110.4101	279.5155	446.1761 (98)
Space heating												1989.7339 (98)
Space heating per m2												(98) / (4) = 28.3599 (99)

8c. Space cooling requirement

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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												2198.6010 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	434.9268	335.6231	247.6501	107.6634	27.7688	0.0000	0.0000	0.0000	0.0000	110.4101	279.5155	446.1761 (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)	480.5821	370.8542	273.6466	118.9651	30.6838	0.0000	0.0000	0.0000	0.0000	122.0001	308.8569	493.0122 (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	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264 (64)
Efficiency of water heater (217)m	89.6284	89.5449	89.3015	88.7457	87.8765	87.3000	87.3000	87.3000	87.3000	88.7362	89.4007	87.3000 (216)
Fuel for water heating, kWh/month	175.2209	153.8201	160.1960	142.0136	138.7210	122.1389	114.8065	129.4272	130.2861	147.4082	157.8179	170.1113 (219)
Water heating fuel used												1741.9677 (219)
Annual totals kWh/year												
Space heating fuel - main system												2198.6010 (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)												318.0210 (232)
Total delivered energy for all uses												4333.5897 (238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2198.6010	3.8700	85.0859 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1741.9677	3.8700	67.4142 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	318.0210	18.9000	60.1060 (250)
Additional standing charges			93.0000 (251)
Total energy cost			319.7810 (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	2198.6010	0.2160	474.8978 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1741.9677	0.2160	376.2650 (264)
Space and water heating			851.1628 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	318.0210	0.5190	165.0529 (268)
Total kg/year			1055.1407 (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	2198.6010	1.2200	2682.2932 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1741.9677	1.2200	2125.2006 (264)
Space and water heating			4807.4938 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	318.0210	3.0700	976.3245 (268)
Primary energy kWh/year			6014.0683 (272)
Primary energy kWh/m2/year			85.7193 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 87

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	+ 1.3	-£ 27	-175 kg (16.6%)
U Solar photovoltaic panels	+ 11.6	-£ 345	-947 kg (107.6%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£27	2.50 kg/m²	B 85	B 89
Solar photovoltaic panels	£345	13.49 kg/m²	A 96	A 99
Total Savings	£371	15.99 kg/m²		

Potential energy efficiency rating: A 96
 Potential environmental impact rating: A 99

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	£74	£84	-£9
Mains gas	£246	£209	£36
Space heating	£192	£192	£0
Water heating	£67	£41	£27
Lighting	£60	£60	£0
Generated (PV)	-£0	-£345	£345
Total cost of fuels	£320	-£52	£372
Total cost of uses	£319	-£52	£372
Delivered energy	62 kWh/m²	23 kWh/m²	39 kWh/m²
Carbon dioxide emissions	1.1 tonnes	-0.1 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	-1 kg/m²	16 kg/m²
Primary energy	86 kWh/m²	-8 kWh/m²	94 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	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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)	=	0.3635 (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	0.4634	0.4543	0.4452	0.3998	0.3907	0.3453	0.3453	0.3362	0.3635	0.3907	0.4089	0.4271 (22b)
Effective ac	0.6074	0.6032	0.5991	0.5799	0.5763	0.5596	0.5596	0.5565	0.5660	0.5763	0.5836	0.5912 (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			2.0600	1.4000	2.8840		(26)
Opening Type 2 (Uw = 1.30)			12.5900	1.2357	15.5580		(27)
Heat Loss Floor 1			35.8800	0.1900	6.8172	75.0000	2691.0000 (28a)
Brick Cavity	82.1100	14.6500	67.4600	0.2500	16.8650	60.0000	4047.6000 (29a)
External Roof 1	34.2800		34.2800	0.1100	3.7708	9.0000	308.5200 (30)
Porch Roof	1.9500		1.9500	0.1100	0.2145	9.0000	17.5500 (30)
Total net area of external elements Aum (A, m ²)			154.2200				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.1095		(33)
Party Wall 1			37.5200	0.0000	0.0000	110.0000	4127.2000 (32)
Internal Wall 1			126.7100			9.0000	1140.3900 (32c)
Internal Wall 2			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			34.2800			18.0000	617.0400 (32d)
Internal Ceiling 1			34.2800			18.0000	617.0400 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15177.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3247 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9427 (36)
Total fabric heat loss						(33) + (36) =	55.0522 (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	33.8582	33.6258	33.3980	32.3279	32.1277	31.1957	31.1957	31.0231	31.5547	32.1277	32.5327	32.9561 (38)
Heat transfer coeff	88.9104	88.6780	88.4502	87.3801	87.1799	86.2479	86.2479	86.0753	86.6069	87.1799	87.5849	88.0083 (39)
Average = Sum(39)m / 12 =												87.3791 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2673	1.2639	1.2607	1.2454	1.2426	1.2293	1.2293	1.2268	1.2344	1.2426	1.2484	1.2544 (40)
HLP (average)												1.2454 (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												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy conte	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design
System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Energy content (annual)												Total = Sum(45)m =	1378.8803 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.4441	18.7551	19.3536	16.8729	16.1900	13.9707	12.9459	14.8556	15.0331	17.5196	19.1240	20.7674 (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	14.0873	12.7040	14.0334	13.5447	13.9700	13.4891	13.9199	13.9524	13.5194	14.0071	13.5970	14.0769 (61)	
Total heat required for water heating calculated for each month	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264 (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												1.3153 (H8)	
Utilisation factor												0.5325 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												87.6376 (H14)	
Volume ratio Veff/V												0.8558 (H15)	
Solar storage volume factor												0.9689 (H16)	
Solar input												-822.6836 (H17)	
Solar input	-23.8562	-39.8091	-67.7995	-90.8647	-112.2556	-110.3652	-108.9067	-95.1523	-74.5233	-50.8907	-28.2969	-19.9636 (63)	
Solar input (sum of months) = Sum(63)m =												-822.6836 (63)	
Output from w/h	133.1915	97.9290	75.2578	35.1662	9.6475	0.0000	0.0000	17.8377	39.2165	79.9137	112.7935	132.5628 (64)	
Total per year (kWh/year) = Sum(64)m =												733.5163 (64)	
Heat gains from water heating, kWh/month	51.0562	44.7498	46.4088	40.7878	39.3803	34.3407	32.1768	36.4181	36.7031	42.3369	45.7908	49.5537 (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	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.0192	39.9856	32.5185	24.6186	18.4027	15.5363	16.7875	21.8211	29.2882	37.1881	43.4040	46.2704	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.0302	298.0916	290.3768	273.9528	253.2204	233.7349	220.7174	217.6559	225.3708	241.7948	262.5271	282.0126	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	(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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	(71)
Water heating gains (Table 5)	68.6239	66.5920	62.3774	56.6498	52.9305	47.6954	43.2484	48.9491	50.9766	56.9044	63.5983	66.6044	(72)
Total internal gains	507.4233	503.4194	484.0228	453.9712	423.3037	395.7167	379.5034	387.1761	404.3856	434.6374	468.2796	493.6375	(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	
East			7.7400		19.6403		0.4400		0.0000		0.7700		51.5029 (76)	
West			4.8500		19.6403		0.4400		0.0000		0.7700		32.2725 (80)	

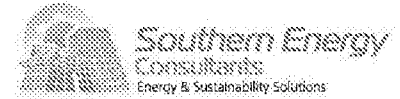
Solar gains	83.7754	163.8824	269.8910	393.6200	482.3960	493.8182	470.1350	403.8391	313.8944	194.4603	104.4581	68.8928 (83)		
Total gains	591.1987	667.3018	753.9138	847.5912	905.6997	889.5349	849.6384	791.0152	718.2801	629.0977	572.7376	562.5303 (84)		

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	47.4177	47.5420	47.6644	48.2481	48.3589	48.8815	48.8815	48.9795	48.6789	48.3589	48.1353	47.9037
alpha	4.1612	4.1695	4.1776	4.2165	4.2239	4.2588	4.2588	4.2653	4.2453	4.2239	4.2090	4.1936
util living area	0.9868	0.9772	0.9522	0.8859	0.7614	0.5869	0.4385	0.4871	0.7285	0.9232	0.9774	0.9892 (86)
MIT	19.6811	19.8644	20.1727	20.5497	20.8218	20.9559	20.9899	20.9844	20.8906	20.5209	20.0341	19.6474 (87)
Th 2	19.8666	19.8692	19.8718	19.8838	19.8861	19.8966	19.8966	19.8986	19.8926	19.8861	19.8815	19.8767 (88)
util rest of house	0.9832	0.9709	0.9388	0.8550	0.7022	0.4985	0.3325	0.3768	0.6443	0.8951	0.9700	0.9861 (89)
MIT 2	18.1462	18.4119	18.8526	19.3778	19.7188	19.8677	19.8928	19.8920	19.8087	19.3553	18.6685	18.1043 (90)
Living area fraction	18.4663	18.7148	19.1279	19.6221	19.9488	20.0946	20.1215	20.1198	20.0343	19.5983	18.9532	18.4261 (91)
MIT	18.4663	18.7148	19.1279	19.6221	19.9488	20.0946	20.1215	20.1198	20.0343	19.5983	18.9532	18.4261 (92)
Temperature adjustment	18.3163	18.5648	18.9779	19.4721	19.7988	19.9446	19.9715	19.9698	19.8843	19.4483	18.8032	-0.1500
adjusted MIT	18.3163	18.5648	18.9779	19.4721	19.7988	19.9446	19.9715	19.9698	19.8843	19.4483	18.8032	18.2761 (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	0.9759	0.9609	0.9251	0.8414	0.6971	0.5025	0.3399	0.3842	0.6436	0.8810	0.9600	0.9797	(94)
Useful gains	576.9382	641.1847	697.4494	713.1700	631.3465	447.0109	288.7916	303.9173	462.2877	554.2646	549.8213	551.1352	(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	1246.1923	1211.7682	1103.6682	923.7947	706.0528	460.9605	290.7871	307.2696	500.9588	771.3975	1025.0280	1238.8097	(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	497.9250	383.4321	302.2268	151.6498	55.5815	0.0000	0.0000	0.0000	0.0000	161.5469	342.1488	511.6298	(98)
Space heating												2406.1409	(98)
Space heating per m2											(98) / (4) =	34.2951	(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													2658.7192 (211)
Space heating requirement	497.9250	383.4321	302.2268	151.6498	55.5815	0.0000	0.0000	0.0000	0.0000	161.5469	342.1488	511.6298	(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)	550.1934	423.6819	333.9523	167.5689	61.4161	0.0000	0.0000	0.0000	0.0000	178.5049	378.0650	565.3368	(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	133.1915	97.9290	75.2578	35.1662	9.6475	0.0000	0.0000	17.8377	39.2165	79.9137	112.7935	132.5628	(64)
Efficiency of water heater	89.8053	89.8301	89.8434	89.8798	90.0120	87.3000	87.3000	87.3000	87.3000	89.4153	89.6850	89.8225	(217)
Fuel for water heating, kWh/month	148.3114	109.0158	83.7655	39.1258	10.7180	0.0000	0.0000	20.4326	44.9215	89.3737	125.7664	147.5831	(219)
Water heating fuel used												819.0139	(219)
Annual totals kWh/year													
Space heating fuel - main system												2658.7192	(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)												318.0210	(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												2193.5148	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2658.7192	3.4800	92.5234 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	819.0139	3.4800	28.5017 (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	318.0210	13.1900	41.9470 (250)
Additional standing charges			120.0000 (251)
Energy saving/generation technologies			
PV Unit	-1727.2394	13.1900	-227.8229 (252)
Total energy cost			71.6367 (255)

11a. SAP rating - Individual heating systems

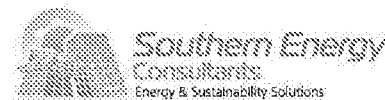
Energy cost deflator (Table 12):			0.4200 (256)
Energy cost factor (ECF)		[(255) x (256)] / [(4) + 45.0] =	0.2613 (257)
SAP value			96.3553
SAP rating (Section 12)			96 (258)
SAP band			A

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

Energy	Emission factor	Emissions
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FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2658.7192	0.2160	574.2834 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	819.0139	0.2160	176.9070 (264)
Space and water heating			751.1904 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	318.0210	0.5190	165.0529 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			84.6810 (272)
CO2 emissions per m2			1.2100 (273)
EI value			99.0147
EI rating			99 (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	35.8800 (1b)	x 2.3100 (2b)	= 82.8828 (1b) - (3b)
First floor	34.2800 (1c)	x 2.5100 (2c)	= 86.0428 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	70.1600		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 168.9256 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m3 per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					30.0000 / (5) = 0.1776 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4276 (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) =		0.3635 (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	0.3816	0.3635	0.3635	0.3362	0.3362	0.2998	0.3089	0.2908	0.2998	0.3180	0.3180	0.3453 (22b)
Effective ac	0.5728	0.5660	0.5660	0.5565	0.5565	0.5450	0.5477	0.5423	0.5450	0.5506	0.5506	0.5596 (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			2.0600	1.4000	2.8840		(26)
Opening Type 2 (Uw = 1.30)			12.5900	1.2357	15.5580		(27)
Heat Loss Floor 1			35.8800	0.1900	6.8172	75.0000	2691.0000 (28a)
Brick Cavity	82.1100	14.6500	67.4600	0.2500	16.8650	60.0000	4047.6000 (29a)
External Roof 1	34.2800		34.2800	0.1100	3.7708	9.0000	308.5200 (30)
Porch Roof	1.9500		1.9500	0.1100	0.2145	9.0000	17.5500 (30)
Total net area of external elements Aum (A, m ²)			154.2200				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.1095			(33)
Party Wall 1			37.5200	0.0000	0.0000	110.0000	4127.2000 (32)
Internal Wall 1			126.7100			9.0000	1140.3900 (32c)
Internal Wall 2			21.4800			75.0000	1611.0000 (32c)
Internal Floor 1			34.2800			18.0000	617.0400 (32d)
Internal Ceiling 1			34.2800			18.0000	617.0400 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =				15177.3400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3247 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.9427 (36)
Total fabric heat loss			(33) + (36) =				55.0522 (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	31.9321	31.5547	31.5547	31.0231	31.0231	30.3788	30.5329	30.2292	30.3788	30.6917	30.6917	31.1957 (38)
Heat transfer coeff	86.9843	86.6069	86.6069	86.0753	86.0753	85.4310	85.5851	85.2814	85.4310	85.7439	85.7439	86.2479 (39)
Average = Sum(39)m / 12 =												85.9844 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2398	1.2344	1.2344	1.2268	1.2268	1.2177	1.2199	1.2155	1.2177	1.2221	1.2221	1.2293 (40)
HLP (average)												1.2255 (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												2.2500 (42)
Average daily hot water use (litres/day)												87.6376 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	96.4013	92.8958	89.3903	85.8848	82.3793	78.8738	78.8738	82.3793	85.8848	89.3903	92.8958	96.4013 (44)
Energy conte	142.9604	125.0341	129.0240	112.4862	107.9332	93.1381	86.3062	99.0376	100.2204	116.7972	127.4933	138.4495 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Energy content (annual)	Total = Sum(45)m =											1378.8803 (45)
Distribution loss (46)m = 0.15 x (45)m												
	21.4441	18.7551	19.3536	16.8729	16.1900	13.9707	12.9459	14.8556	15.0331	17.5196	19.1240	20.7674 (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	14.0873	12.7040	14.0334	13.5447	13.9700	13.4891	13.9199	13.9524	13.5194	14.0071	13.5970	14.0769 (61)
Total heat required for water heating calculated for each month	157.0477	137.7381	143.0573	126.0309	121.9032	106.6273	100.2261	112.9900	113.7398	130.8044	141.0904	152.5264 (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												1.3891 (H8)
Utilisation factor												0.5132 (H9)
Collector performance factor												0.8793 (H10)
Dedicated solar storage volume												75.0000 (H11)
Effective solar volume												75.0000 (H13)
Daily hot water demand												87.6376 (H14)
Volume ratio Veff/V												0.8558 (H15)
Solar storage volume factor												0.9689 (H16)
Solar input												-837.3990 (H17)
Solar input	-25.7747	-38.7394	-65.2420	-90.1844	-108.6123	-114.3098	-111.5650	-99.6282	-77.7601	-52.8988	-31.3299	-21.3545 (63)
	Solar input (sum of months) = Sum(63)m =											-837.3990 (63)
Output from w/h	131.2730	98.9988	77.8153	35.8465	13.2908	0.0000	0.0000	13.3618	35.9797	77.9056	109.7605	131.1719 (64)
	Total per year (kWh/year) = Sum(64)m =											725.4038 (64)
Heat gains from water heating, kWh/month	51.0562	44.7498	46.4088	40.7878	39.3803	34.3407	32.1768	36.4181	36.7031	42.3369	45.7908	49.5537 (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	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	135.0002	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	45.0192	39.9856	32.5185	24.6186	18.4027	15.5363	16.7875	21.8211	29.2882	37.1881	43.4040	46.2704	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	295.0302	298.0916	290.3768	273.9528	253.2204	233.7349	220.7174	217.6559	225.3708	241.7948	262.5271	282.0126	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	50.7500	(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)	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	-90.0001	(71)
Water heating gains (Table 5)	68.6239	66.5920	62.3774	56.6498	52.9305	47.6954	43.2484	48.9491	50.9766	56.9044	63.5983	66.6044	(72)
Total internal gains	507.4233	503.4194	484.0228	453.9712	423.3037	395.7167	379.5034	387.1761	404.3856	434.6374	468.2796	493.6375	(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	
East			7.7400	22.3313		0.4400		0.0000		0.7700	58.5597 (76)	
West			4.8500	22.3313		0.4400		0.0000		0.7700	36.6944 (80)	

Solar gains	95.2540	167.6133	272.1744	407.9114	486.0436	532.0636	501.2255	440.9596	342.7416	212.2430	121.6754	77.5722 (83)
Total gains	602.6773	671.0327	756.1972	861.8826	909.3473	927.7804	880.7289	828.1357	747.1272	646.8804	589.9549	571.2098 (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	48.4677	48.6789	48.6789	48.9795	48.9795	49.3489	49.2600	49.4355	49.3489	49.1688	49.1688	48.8815
alpha	4.2312	4.2453	4.2453	4.2653	4.2653	4.2899	4.2840	4.2957	4.2899	4.2779	4.2779	4.2588
util living area	0.9830	0.9723	0.9395	0.8493	0.6842	0.4513	0.3000	0.3277	0.6199	0.8878	0.9679	0.9859 (86)
MIT	19.8368	19.9966	20.3116	20.6705	20.9020	20.9876	20.9984	20.9977	20.9522	20.6579	20.1974	19.8085 (87)
Th 2	19.8883	19.8926	19.8926	19.8986	19.8986	19.9059	19.9041	19.9076	19.9059	19.9023	19.9023	19.8966 (88)
util rest of house	0.9781	0.9645	0.9223	0.8095	0.6118	0.3568	0.1946	0.2168	0.5200	0.8472	0.9572	0.9817 (89)
MIT 2	18.3867	18.6186	19.0632	19.5466	19.8177	19.9001	19.9039	19.9072	19.8766	19.5480	18.9166	18.3518 (90)
Living area fraction	fLA = Living area / (4) =											
MIT	18.6891	18.9059	19.3235	19.7809	20.0438	20.1269	20.1321	20.1346	20.1009	19.7795	19.1836	18.6556 (91)
Temperature adjustment	-0.1500											
adjusted MIT	18.5391	18.7559	19.1735	19.6309	19.8938	19.9769	19.9821	19.9846	19.9509	19.6295	19.0336	18.5056 (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	0.9697	0.9537	0.9082	0.7983	0.6115	0.3631	0.2022	0.2247	0.5244	0.8349	0.9456	0.9743	(94)
Useful gains	584.4089	639.9558	686.8061	688.0592	556.0649	336.8405	178.0463	186.0650	391.7892	540.0780	557.8513	556.5037	(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													
	1168.9879	1139.3950	1019.6692	837.5917	593.3886	339.7486	178.1976	186.3030	405.8757	688.4787	946.0673	1156.2027	(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													
	434.9268	335.6231	247.6501	107.6634	27.7688	0.0000	0.0000	0.0000	0.0000	110.4101	279.5155	446.1761	(98)
Space heating													1989.7339 (98)
Space heating per m2												(98) / (4) =	28.3599 (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													2198.6010 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	434.9268	335.6231	247.6501	107.6634	27.7688	0.0000	0.0000	0.0000	0.0000	110.4101	279.5155	446.1761	(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)	480.5821	370.8542	273.6466	118.9651	30.6838	0.0000	0.0000	0.0000	0.0000	122.0001	308.8569	493.0122	(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	131.2730	98.9988	77.8153	35.8465	13.2908	0.0000	0.0000	13.3618	35.9797	77.9056	109.7605	131.1719	(64)
Efficiency of water heater	89.7374	89.7506	89.7138	89.6789	89.4388	87.3000	87.3000	87.3000	87.3000	89.1481	89.5742	89.7525	(217)
Fuel for water heating, kWh/month	146.2857	110.3042	86.7373	39.9720	14.8602	0.0000	0.0000	15.3056	41.2138	87.3889	122.5358	146.1483	(219)
Water heating fuel used												810.7521	(219)
Annual totals kWh/year													
Space heating fuel - main system												2198.6010	(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)												318.0210	(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												1628.2145	(238)

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

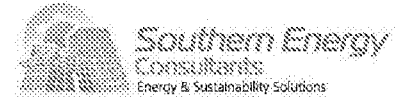
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2198.6010	3.8700	85.0859	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	810.7521	3.8700	31.3761	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	318.0210	18.9000	60.1060	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			-51.5732	(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	2198.6010	0.2160	474.8978	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	810.7521	0.2160	175.1225	(264)
Space and water heating			650.0203	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	318.0210	0.5190	165.0529	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)
Total kg/year			-66.7907	(272)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

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

	Energy kWh/year	Primary energy factor kg CO2/kWh	Primary energy kWh/year	
Space heating - main system 1	2198.6010	1.2200	2682.2932	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	810.7521	1.2200	989.1176	(264)
Space and water heating			3671.4108	(265)
Pumps and fans	125.0000	3.0700	383.7500	(267)
Energy for lighting	318.0210	3.0700	976.3245	(268)
Energy saving/generation technologies				
FV Unit	-1824.1596	3.0700	-5600.1701	(269)
Primary energy kWh/year			-568.6848	(272)
Primary energy kWh/m2/year			-8.1055	(273)

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

Overheating Calculation Input Data

Dwelling type	SemiDetached House
Number of storeys	2
Cross ventilation possible	Yes
SAP Region	Thames Valley
Front of dwelling faces	West
Overshading	Average or unknown
Thermal mass parameter	216.3 (calculated from construction elements)
Night ventilation	Yes
Ventilation rate during hot weather (ach)	4.00 (Windows half open)

Overheating Calculation

Summer ventilation heat loss coefficient	222.98	(P1)
Transmission heat loss coefficient	55.05	(37)
Summer heat loss coefficient	278.03	(P2)

Overhangs

Orientation	Ratio	Z_overhangs	Overhang type
East	0.000	1.000	None
West	0.000	1.000	None

Solar shading

Orientation	Z blinds	Solar access	Z overhangs	Z summer
East	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
East	7.7400	117.5071	0.4400	0.0000	0.9000	360.1639
West	4.8500	117.5071	0.4400	0.0000	0.9000	225.6841

total: 585.8479

Solar gains	Jun	Jul	Aug	(P4)
Internal gains	622	586	515	
Total summer gains	393	377	384	
	1015	962	900	(P5)
Summer gain/loss ratio	3.65	3.46	3.24	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 216.3)	0.49	0.49	0.49	
Threshold temperature	20.13	21.85	21.52	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	
Assessment of likelihood of high internal temperature:	Slight			