

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Property Reference	SECANG007a			Issued on Date	04/02/2021
Assessment Reference	001	Prop Type Ref	Sem Bri Ga Ea		
Property	2B3P, Plot 68,76				
SAP Rating	83 B	DER	18.66	TER	19.20
Environmental	36 B	% DER<TER	2.83		
CO ₂ Emissions (t/year)	1.12	DFEE	49.73	TFEE	52.79
General Requirements Compliance	Pass	% DFEE<TFEE	5.79		
Assessor Details	Mr. Stuart Harvey, Stuart Harvey, [REDACTED]			Assessor ID	T555-0001
Client	Persimmon Homes Thames Valley				

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

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 73 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) 19.20 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.66 kgCO₂/m² OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE) 52.8 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE) 49.7 kWh/m²/yr OK

2 Fabric U-values

Element	Average	Highest	
External wall	0.25 (max. 0.30)	0.25 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.19 (max. 0.25)	0.19 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.60 (max. 3.30)	OK

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

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

4 Heating efficiency

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

Secondary heating system:

None

5 Cylinder insulation

Hot water storage No cylinder

6 Controls

Space heating controls: Time and temperature zone control OK

Hot water controls:

No cylinder

Boiler interlock

Yes OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Thames Valley): Slight OK

Based on:

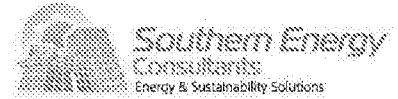
Overshading: Average
Windows facing East: 3.58 m², No overhang
Windows facing South: 1.79 m², No overhang
Windows facing West: 3.24 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key Features

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

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =		0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4130 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		46.2657		(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)						(28)...(30) + (32) + (32a)...(32e) =	15847.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss						(33) + (36) =	54.3873 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	90.7390	90.5029	90.2715	89.1846	88.9812	88.0345	88.0345	87.8592	88.3992	88.9812	89.3926	89.8227 (39)
Average = Sum(39)m / 12 =												89.1836 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2389	1.2357	1.2325	1.2177	1.2149	1.2020	1.2020	1.1996	1.2070	1.2149	1.2205	1.2264 (40)
HLP (average)												1.2177 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r16

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Energy content (annual)	Total = Sum(45)m = 1405.8389 (45)										
Distribution loss (46)m = 0.15 x (45)m											
21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083 (61)
Total heat required for water heating calculated for each month											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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											
159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)
Heat gains from water heating, kWh/month											
51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3519	18.0764	14.7007	11.1294	8.3194	7.0235	7.5892	9.8647	13.2404	16.8117	19.6218	20.9176	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	355.7994	353.5767	340.5500	319.7413	298.7517	278.5962	265.5942	271.5575	282.3542	303.3671	327.3895	345.2725	(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					3.5800	19.6403	0.4400	0.0000	0.7700		23.8218 (76)	
South					1.7900	46.7521	0.4400	0.0000	0.7700		28.3529 (78)	
West					3.2400	19.6403	0.4400	0.0000	0.7700		21.5594 (80)	
Solar gains	73.7340	135.2098	205.3495	280.0757	330.9776	334.5431	320.1761	282.3730	231.8253	155.4233	90.1927	61.8187 (83)
Total gains	429.5334	488.7865	545.8995	599.8170	629.7293	613.1393	585.7702	553.9305	514.1795	458.7904	417.5823	407.0912 (84)

7. Mean internal temperature (heating season)

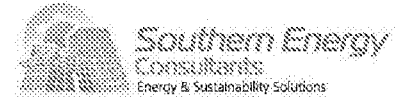
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	48.5150	48.6416	48.7663	49.3606	49.4734	50.0054	50.0054	50.1052	49.7992	49.4734	49.2457	49.0099
alpha	4.2343	4.2428	4.2511	4.2907	4.2982	4.3337	4.3337	4.3403	4.3199	4.2982	4.2830	4.2673
util living area	0.9966	0.9935	0.9857	0.9626	0.9034	0.7766	0.6193	0.6679	0.8742	0.9747	0.9938	0.9973 (86)
MIT	19.4677	19.6300	19.9123	20.2899	20.6338	20.8761	20.9651	20.9515	20.7724	20.3228	19.8294	19.4416 (87)
Th 2	19.8890	19.8915	19.8941	19.9059	19.9081	19.9184	19.9184	19.9203	19.9144	19.9081	19.9036	19.8989 (88)
util rest of house	0.9955	0.9915	0.9810	0.9493	0.8661	0.6901	0.4861	0.5378	0.8119	0.9632	0.9915	0.9965 (89)
MIT 2	17.8519	18.0902	18.5020	19.0515	19.5245	19.8246	19.9031	19.8966	19.7139	19.1068	18.3902	17.8204 (90)
Living area fraction	18.1431	18.3677	18.7562	19.2747	19.7244	20.0141	20.0945	20.0867	19.9047	19.3259	18.6496	18.1126 (91)
MIT	17.9931	18.2177	18.6062	19.1247	19.5744	19.8641	19.9445	19.9367	19.7547	19.1759	18.4996	17.9626 (92)
Temperature adjustment												-0.1500
adjusted MIT	17.9931	18.2177	18.6062	19.1247	19.5744	19.8641	19.9445	19.9367	19.7547	19.1759	18.4996	17.9626 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	426.3918	482.4180	531.2262	561.6319	536.4425	420.0446	286.8071	299.1073	411.5444	436.7643	412.1346	404.6982	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1242.4975	1205.2949	1092.8419	911.8818	700.6728	463.4265	294.4316	310.7339	499.8671	763.0963	1019.0366	1236.1915	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	607.1827	485.7732	417.8421	252.1799	122.1873	0.0000	0.0000	0.0000	0.0000	242.7910	436.9695	618.6310	(98)
Space heating												3183.5567	(98)
Space heating per m ²												43.4675	(99)

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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													3517.7422	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	607.1827	485.7732	417.8421	252.1799	122.1873	0.0000	0.0000	0.0000	0.0000	242.7910	436.9695	618.6310	(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)	670.9201	536.7660	461.7040	278.6518	135.0136	0.0000	0.0000	0.0000	0.0000	268.2774	482.8392	683.5701	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)	
Efficiency of water heater (217)m	89.8139	89.7631	89.6509	89.3954	88.8593	87.3000	87.3000	87.3000	87.3000	89.3404	89.6869	89.8394	(217)	
Fuel for water heating, kWh/month	177.9856	156.1819	162.3976	143.4518	139.5710	124.2327	116.7468	131.6541	132.5400	148.9782	160.1062	172.8038	(219)	
Water heating fuel used												1766.6495	(219)	
Annual totals kWh/year														
Space heating fuel - main system													3517.7422	(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)													359.4216	(232)
Total delivered energy for all uses													5718.8133	(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	3517.7422	0.2160	759.8323 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1766.6495	0.2160	381.5963 (264)
Space and water heating			1141.4286 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Total CO2, kg/year			1366.8934 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.6600 (273)

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

DER		18.6600	ZC1
Total Floor Area	TFA	73.2400	
Assumed number of occupants	N	2.3221	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5652	ZC2
CO2 emissions from cooking, equation (L16)		2.3857	ZC3
Total CO2 emissions		37.6109	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.6109	ZC8

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CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

1. Overall dwelling dimensions

	Area (m ²)	Storey height (m)	Volume (m ³)
Ground floor	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500			(26)				
TER Semi-glazed door			2.1500	1.2000	2.5800			(26a)				
TER Opening Type (Uw = 1.40)			8.6100	1.3258	11.4148			(27)				
Heat Loss Floor 1			36.6200	0.1300	4.7606			(28a)				
Brick Cavity	85.6700	12.9100	72.7600	0.1800	13.0968			(29a)				
External Roof 1	36.6200		36.6200	0.1300	4.7606			(30)				
Total net area of external elements Aum(A, m2)			158.9100					(31)				
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7628			(33)				
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K								250.0000 (35)				
Thermal bridges (Sum(L x Psi) calculated using Appendix K)								9.0489 (36)				
Total fabric heat loss						(33) + (36) =		47.8117 (37)				
Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)												
(38)m	Jan 36.3517	Feb 36.1156	Mar 35.8842	Apr 34.7973	May 34.5939	Jun 33.6472	Jul 33.6472	Aug 33.4719	Sep 34.0119	Oct 34.5939	Nov 35.0053	Dec 35.4354 (38)
Heat transfer coeff	84.1634	83.9273	83.6959	82.6089	82.4056	81.4589	81.4589	81.2836	81.8236	82.4056	82.8170	83.2471 (39)
Average = Sum(39)m / 12 =												82.6080 (39)
HLP	Jan 1.1491	Feb 1.1459	Mar 1.1428	Apr 1.1279	May 1.1251	Jun 1.1122	Jul 1.1122	Aug 1.1098	Sep 1.1172	Oct 1.1251	Nov 1.1308	Dec 1.1366 (40)
HLP (average)												1.1279 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
Daily hot water use	Jan 98.2861	Feb 94.7120	Mar 91.1380	Apr 87.5640	May 83.9899	Jun 80.4159	Jul 80.4159	Aug 83.9899	Sep 87.5640	Oct 91.1380	Nov 94.7120	Dec 98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)
Energy content (annual)										Total = Sum(45)m =		1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	0.0000	0.0000	(57)
Combi loss	50.0855	43.5935	46.4429	43.1822	42.8003	39.6571	40.9791	42.8003	43.1822	46.4429	46.7073	50.0855			(61)
Total heat required for water heating calculated for each month	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419			(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	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419			(64)
Heat gains from water heating, kWh/month	60.9851	53.2850	55.3499	48.9285	47.2895	41.4882	39.5026	44.2739	44.7704	51.2051	54.8972	59.4559			(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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)		
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3519	18.0764	14.7007	11.1294	8.3194	7.0235	7.5892	9.8647	13.2404	16.8117	19.6218	20.9176	(67)		
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)		
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)		
Water heating gains (Table 5)	81.9692	79.2932	74.3951	67.9562	63.5612	57.6225	53.0949	59.5079	62.1811	68.8240	76.2461	79.9138	(72)		
Total internal gains	367.8912	365.0642	351.4367	330.0289	308.4365	287.6799	274.6844	281.2484	292.6510	314.2629	338.8823	357.3679	(73)		

6. Solar gains

[Jan]	Area m ²	Solar flux Table 6a W/m ²	Specific data or Table 6b	Specific data or Table 6c	FF	Access factor Table 6d	Gains W	
East	3.5800	19.6403	0.6300		0.7000	0.7700	21.4883	(76)
South	1.7900	46.7521	0.6300		0.7000	0.7700	25.5756	(78)
West	3.2400	19.6403	0.6300		0.7000	0.7700	19.4475	(80)

Solar gains	66.5114	121.9654	185.2346	252.6410	298.5569	301.7731	288.8134	254.7133	209.1169	140.1989	81.3580	55.7633	(83)
Total gains	434.4026	487.0296	536.6713	582.6699	606.9934	589.4530	563.4978	535.9617	501.7679	454.4617	420.2402	413.1312	(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	60.4314	60.6014	60.7690	61.5685	61.7205	62.4378	62.4378	62.5724	62.1595	61.7205	61.4139	61.0966		
alpha	5.0288	5.0401	5.0513	5.1046	5.1147	5.1625	5.1625	5.1715	5.1440	5.1147	5.0943	5.0731		
util living area	0.9981	0.9963	0.9909	0.9724	0.9169	0.7823	0.6122	0.6609	0.8823	0.9813	0.9962	0.9985	(86)	
MIT	19.7535	19.8887	20.1246	20.4426	20.7297	20.9223	20.9826	20.9746	20.8428	20.4705	20.0574	19.7325	(87)	
Th 2	19.9609	19.9635	19.9661	19.9781	19.9804	19.9909	19.9909	19.9928	19.9868	19.9804	19.9758	19.9710	(88)	
util rest of house	0.9975	0.9950	0.9875	0.9613	0.8812	0.6953	0.4838	0.5339	0.8197	0.9717	0.9947	0.9981	(89)	
MIT 2	18.2989	18.4981	18.8432	19.3086	19.7022	19.9355	19.9841	19.9817	19.8538	19.3551	18.7539	18.2755	(90)	
Living area fraction	18.5611	18.7487	19.0741	19.5130	19.8874	20.1134	20.1640	20.1606	20.0321	19.5561	18.9888	18.5381	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.5611	18.7487	19.0741	19.5130	19.8874	20.1134	20.1640	20.1606	20.0321	19.5561	18.9888	18.5381	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Useful gains	432.7273	483.4810	527.7581	556.2062	532.5120	416.7954	285.6572	298.2463	412.9689	439.0437	417.0738	411.8874	(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	1200.2609	1162.2866	1052.4026	876.7263	674.6854	449.1121	290.3230	305.6765	485.3815	738.0346	984.5962	1193.6069	(97)	
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000	(97a)	
Space heating kWh	571.0450	456.1573	390.3355	230.7745	105.7770	0.0000	0.0000	0.0000	0.0000	222.4492	408.6161	581.5993	(98)	
Space heating per m ²												2966.7539	(98)	
												40.5073	(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

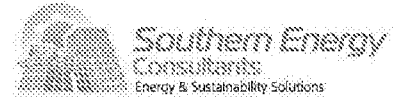
Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													93.4000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													3176.3961 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	571.0450	456.1573	390.3355	230.7745	105.7770	0.0000	0.0000	0.0000	0.0000	222.4492	408.6161	581.5993	(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)	611.3972	488.3912	417.9181	247.0819	113.2516	0.0000	0.0000	0.0000	0.0000	238.1683	437.4905	622.6973	(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	195.8409	171.0721	177.9894	157.8677	152.8438	134.6162	128.9726	143.7742	145.3621	165.5237	176.6933	191.2419	(64)
Efficiency of water heater (217)m	87.5867	87.4017	86.9740	86.0058	84.1451	80.3000	80.3000	80.3000	80.3000	85.7960	87.0931	87.6713	(217)
Fuel for water heating, kWh/month	223.5967	195.7309	204.6468	183.5546	181.6430	167.6417	160.6135	179.0464	181.0238	192.9270	202.8787	218.1351	(219)
Water heating fuel used												2291.4380	(219)
Annual totals kWh/year													
Space heating fuel - main system												3176.3961	(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)												359.4216	(232)
Total delivered energy for all uses												5902.2557	(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	3176.3961	0.2160	686.1016 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	2291.4380	0.2160	494.9506 (264)
Space and water heating			1181.0522 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Total CO2, kg/m2/year			1406.5170 (272)
Emissions per m2 for space and water heating			16.1258 (272a)
Fuel factor (mains gas)			1.0000
Emissions per m2 for lighting			2.5470 (272b)
Emissions per m2 for pumps and fans			0.5315 (272c)
Target Carbon Dioxide Emission Rate (TER) = (16.1258 * 1.00) + 2.5470 + 0.5315, rounded to 2 d.p.			19.2000 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			9.0000	329.5800 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15518.3600			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							211.8837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss			(33) + (36) =	54.3873			(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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	90.7390	90.5029	90.2715	89.1846	88.9812	88.0345	88.0345	87.8592	88.3992	88.9812	89.3926	89.8227 (39)
Average = Sum(39)m / 12 =												89.1836 (39)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2389	1.2357	1.2325	1.2177	1.2149	1.2020	1.2020	1.1996	1.2070	1.2149	1.2205	1.2264 (40)
HLP (average)												1.2177 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (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 = 1405.8389 (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	30.9730	27.0892	27.9536	24.3707	23.3842	20.1788	18.6986	21.4570	21.7132	25.3047	27.6220	29.9957 (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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3519	18.0764	14.7007	11.1294	8.3194	7.0235	7.5892	9.8647	13.2404	16.8117	19.6218	20.9176	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	41.6304	40.3113	37.5721	33.8481	31.4304	28.0261	25.1326	28.8400	30.1572	34.0116	38.3639	40.3168	(72)
Total internal gains	324.5524	323.0824	311.6137	292.9208	273.3057	255.0836	243.7221	247.5805	257.6272	276.4505	298.0001	314.7709	(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				3.5800	19.6403		0.4400		0.0000		0.7700		23.8218 (76)
South				1.7900	46.7521		0.4400		0.0000		0.7700		28.3529 (78)
West				3.2400	19.6403		0.4400		0.0000		0.7700		21.5594 (80)
Solar gains	73.7340	135.2098	205.3495	280.0757	330.9776	334.5431	320.1761	282.3730	231.8253	155.4233	90.1927	61.8187	(83)
Total gains	398.2864	458.2921	516.9632	572.9966	604.2833	589.6267	563.8982	529.9535	489.4525	431.8738	388.1929	376.5896	(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	47.5061	47.6300	47.7521	48.3341	48.4446	48.9655	48.9655	49.0632	48.7635	48.4446	48.2216	47.9907	
alpha	4.1671	4.1753	4.1835	4.2223	4.2296	4.2644	4.2644	4.2709	4.2509	4.2296	4.2148	4.1994	
util living area	0.9972	0.9945	0.9875	0.9664	0.9116	0.7912	0.6366	0.6878	0.8869	0.9784	0.9949	0.9978	(86)
MIT	19.3991	19.5655	19.8554	20.2445	20.6019	20.8602	20.9591	20.9428	20.7466	20.2765	19.7694	19.3734	(87)
Th 2	19.8890	19.8915	19.8941	19.9059	19.9081	19.9184	19.9184	19.9203	19.9144	19.9081	19.9036	19.8989	(88)
util rest of house	0.9963	0.9928	0.9834	0.9544	0.8768	0.7070	0.5025	0.5577	0.8288	0.9685	0.9930	0.9971	(89)
MIT 2	18.4320	18.5997	18.8896	19.2808	19.6196	19.8444	19.9057	19.9005	19.7583	19.3182	18.8128	18.4139	(90)
Living area fraction	18.6063	18.7737	19.0636	19.4545	19.7966	20.0275	20.0956	20.0884	19.9364	19.4910	18.9852	18.5868	(91)
MIT	18.6063	18.7737	19.0636	19.4545	19.7966	20.0275	20.0956	20.0884	19.9364	19.4910	18.9852	18.5868	(92)
Temperature adjustment	18.6063	18.7737	19.0636	19.4545	19.7966	20.0275	20.0956	20.0884	19.9364	19.4910	18.9852	18.5868	(93)
adjusted MIT	18.6063	18.7737	19.0636	19.4545	19.7966	20.0275	20.0956	20.0884	19.9364	19.4910	18.9852	18.5868	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	396.2737	453.9402	506.2668	543.1977	527.2568	422.5938	296.7109	307.4042	406.3716	416.0502	384.6374	375.0821	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1298.1376	1255.6134	1134.1386	941.2989	720.4495	477.8046	307.7294	324.0567	515.9358	791.1277	1062.4497	1292.2656	(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	670.9867	538.7244	467.1366	286.6328	143.7354	0.0000	0.0000	0.0000	0.0000	279.0576	488.0248	682.3845	(98)
Space heating												3556.6829	(98)
Space heating per m2												48.5620	(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	827.5247	651.4556	667.7302	0.0000	0.0000	0.0000	0.0000	(100)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

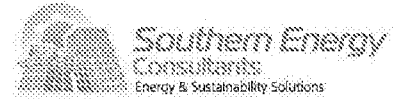


CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7834	0.8600	0.8325	0.0000	0.0000	0.0000	0.0000 (101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	648.2483	560.2270	555.8954	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	776.3995	744.6444	706.6843	0.0000	0.0000	0.0000	0.0000 (103)
Month fracti	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000 (103a)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	92.2689	137.2066	112.1870	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												341.6624 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)												
Intermittency factor	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh												
Space cooling	0.0000	0.0000	0.0000	0.0000	0.0000	23.0672	34.3016	28.0467	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												85.4156 (107)
Space cooling per m2												1.1662 (108)
Energy for space heating												48.5620 (99)
Energy for space cooling												1.1662 (108)
Total												49.7283 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.7 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (5)

2. Ventilation rate

	main heating	secondary heating	other	total	m ³ per hour
Number of chimneys	0	+	0	=	0 * 40 = 0.0000 (6a)
Number of open flues	0	+	0	=	0 * 20 = 0.0000 (6b)
Number of intermittent fans					3 * 10 = 30.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Air changes per hour					
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c)					30.0000 / (5) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =	0.3515 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000 (22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750 (22a)
Adj infilt rate												
Effective ac	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K					
TER Opaque door			2.1500	1.0000	2.1500		(26)					
TER Semi-glazed door			2.1500	1.2000	2.5800		(26a)					
TER Opening Type (Uw = 1.40)			8.6100	1.3258	11.4148		(27)					
Heat Loss Floor 1			36.6200	0.1300	4.7606		(28a)					
Brick Cavity	85.6700	12.9100	72.7600	0.1800	13.0968		(29a)					
External Roof 1	36.6200		36.6200	0.1300	4.7606		(30)					
Total net area of external elements Aum(A, m2)			158.9100				(31)					
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	38.7628		(33)					
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000 (35)					
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							9.0489 (36)					
Total fabric heat loss						(33) + (36) =	47.8117 (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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Average = Sum(39)m / 12 =	84.1634	83.9273	83.6959	82.6089	82.4056	81.4589	81.4589	81.2836	81.8236	82.4056	82.8170	83.2471 (39)
												82.6080 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	1.1491	1.1459	1.1428	1.1279	1.1251	1.1122	1.1122	1.1098	1.1172	1.1251	1.1308	1.1366 (40)
Days in month												1.1279 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy content (annual)	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1405.8389 (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	30.9730	27.0892	27.9536	24.3707	23.3842	20.1788	18.6986	21.4570	21.7132	25.3047	27.6220	29.9957 (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	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	116.1073	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	20.3519	18.0764	14.7007	11.1294	8.3194	7.0235	7.5892	9.8647	13.2404	16.8117	19.6218	20.9176	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	204.7379	206.8624	201.5087	190.1111	175.7238	162.2017	153.1681	151.0436	156.3973	167.7949	182.1822	195.7043	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	34.6107	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	41.6304	40.3113	37.5721	33.8461	31.4304	28.0261	25.1326	28.8400	30.1572	34.0116	38.3639	40.3168	(72)
Total internal gains	324.5524	323.0824	311.6137	292.9208	273.3057	255.0836	243.7221	247.5805	257.6272	276.4505	298.0001	314.7709	(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	3.5800	19.6403	0.6300	0.7000	0.7700	21.4883 (76)
South	1.7900	46.7521	0.6300	0.7000	0.7700	25.5756 (78)
West	3.2400	19.6403	0.6300	0.7000	0.7700	19.4475 (80)

Solar gains	66.5114	121.9654	185.2346	252.6410	298.5569	301.7731	288.8134	254.7133	209.1169	140.1989	81.3580	55.7633 (83)
Total gains	391.0638	445.0477	496.8482	545.5619	571.8626	556.8567	532.5355	502.2938	466.7441	416.6493	379.3581	370.5342 (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	60.4314	60.6014	60.7690	61.5685	61.7205	62.4378	62.4378	62.5724	62.1595	61.7205	61.4139	61.0966	
alpha	5.0288	5.0401	5.0513	5.1046	5.1147	5.1625	5.1625	5.1715	5.1440	5.1147	5.0943	5.0731	
util living area	0.9988	0.9975	0.9935	0.9788	0.9318	0.8089	0.6418	0.6951	0.9056	0.9870	0.9977	0.9991	(86)
MIT	19.6984	19.8357	20.0755	20.4006	20.6992	20.9085	20.9785	20.9680	20.8169	20.4258	20.0057	19.6781	(87)
Th 2	19.9609	19.9635	19.9661	19.9781	19.9804	19.9909	19.9909	19.9928	19.9868	19.9804	19.9758	19.9710	(88)
util rest of house	0.9984	0.9966	0.9910	0.9699	0.9007	0.7249	0.5101	0.5661	0.8501	0.9800	0.9967	0.9988	(89)
MIT 2	18.7712	18.9104	19.1511	19.4811	19.7649	19.9451	19.9850	19.9829	19.8773	19.5106	19.0902	18.7591	(90)
Living area fraction									fLA = Living area / (4) =			0.1802	(91)
MIT	18.9383	19.0771	19.3178	19.6468	19.9333	20.1187	20.1640	20.1605	20.0467	19.6755	19.2552	18.9248	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.9383	19.0771	19.3178	19.6468	19.9333	20.1187	20.1640	20.1605	20.0467	19.6755	19.2552	18.9248	(93)

8. Space heating requirement

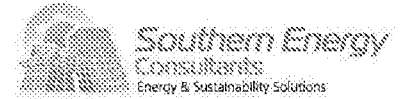
Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	390.2308	443.0819	491.3322	527.1019	514.0526	410.3905	284.4204	296.0445	398.6676	407.1225	377.7149	369.9360	(94)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1232.0102	1189.8477	1072.7927	887.7853	678.4668	449.5498	290.3229	305.6630	486.5765	747.8751	1006.6535	1225.7933	(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	626.2838	501.8267	432.6066	259.6920	122.3242	0.0000	0.0000	0.0000	0.0000	253.5200	452.8358	636.7579	(98)
Space heating												3285.8469	(98)
Space heating per m2											(98) / (4) =	44.8641	(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	765.7137	602.7959	617.7553	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8220	0.8970	0.8724	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	629.3858	540.7189	538.8989	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	738.0968	707.9867	674.3548	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	78.2720	124.4473	100.7792	0.0000	0.0000	0.0000	0.0000	(104)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Space cooling												303.4984 (104)
Cooled fraction												1.0000 (105)
Intermittency factor (Table 10b)												
	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000	(106)
Space cooling kWh												
	0.0000	0.0000	0.0000	0.0000	19.5680	31.1118	25.1948	0.0000	0.0000	0.0000	0.0000	(107)
Space cooling												75.8746 (107)
Space cooling per m2												1.0360 (108)
Energy for space heating												44.8641 (99)
Energy for space cooling												1.0360 (108)
Total												45.9001 (109)
Target Fabric Energy Efficiency (TFEE)												52.8 (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
Effective ac	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15847.9400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss			(33) + (36) =	54.3873			(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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	88.7825	88.3992	88.3992	87.8592	87.8592	87.2047	87.3614	87.0528	87.2047	87.5226	87.5226	88.0345 (39)
Average = Sum(39)m / 12 =												87.7669 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2122	1.2070	1.2070	1.1996	1.1996	1.1907	1.1928	1.1886	1.1907	1.1950	1.1950	1.2020 (40)
HLP (average)												1.1983 (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	2.3221 (42)
Average daily hot water use (litres/day)	89.3510 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (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 =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735	(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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895	(61)
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)
RHI water heating demand													
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569	(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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(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				3.5800	22.3313	0.4400	0.0000	0.7700		27.0857 (76)		
South				1.7900	50.9848	0.4400	0.0000	0.7700		30.9198 (78)		
West				3.2400	22.3313	0.4400	0.0000	0.7700		24.5134 (80)		
Solar gains	82.5189	136.2413	204.5274	287.6917	331.4986	358.7556	339.5613	306.0059	250.3482	167.2550	103.4275	68.5036 (83)
Total gains	609.5531	658.6858	706.2448	757.6297	769.1456	767.6433	731.8460	706.6208	669.4603	618.3507	589.8470	581.4098 (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	49.5841	49.7992	49.7992	50.1052	50.1052	50.4813	50.3908	50.5694	50.4813	50.2979	50.2979	50.0054	
alpha	4.3056	4.3199	4.3199	4.3403	4.3403	4.3654	4.3594	4.3713	4.3654	4.3532	4.3532	4.3337	
util living area	0.9845	0.9771	0.9560	0.8993	0.7744	0.5462	0.3670	0.3901	0.6857	0.9085	0.9716	0.9869	(86)
MIT	19.8502	19.9820	20.2524	20.5825	20.8477	20.9762	20.9968	20.9959	20.9335	20.6290	20.1971	19.8273	(87)
Th 2	19.9102	19.9144	19.9144	19.9203	19.9203	19.9275	19.9258	19.9291	19.9275	19.9240	19.9240	19.9184	(88)
util rest of house	0.9801	0.9705	0.9427	0.8683	0.7070	0.4388	0.2414	0.2617	0.5850	0.8732	0.9619	0.9831	(89)
MIT 2	18.4213	18.6137	18.9994	19.4573	19.7867	19.9157	19.9252	19.9283	19.8845	19.5313	18.9323	18.3942	(90)
Living area fraction	fLA = Living area / (4) =											0.1802	(91)
MIT	18.6788	18.8603	19.2252	19.6601	19.9779	20.1068	20.1183	20.1207	20.0736	19.7291	19.1603	18.6525	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.5288	18.7103	19.0752	19.5101	19.8279	19.9568	19.9683	19.9707	19.9236	19.5791	19.0103	18.5025	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
	0.9720	0.9605	0.9293	0.8540	0.7005	0.4418	0.2465	0.2668	0.5846	0.8591	0.9507	0.9758	(94)
Useful gains	592.4858	632.6356	656.3078	646.9836	538.8065	339.1806	180.3852	188.5327	391.3813	531.2092	560.7384	567.3566	(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	1192.2470	1158.9426	1032.0783	844.3334	599.8971	345.0505	180.6912	188.9670	411.9177	698.3555	963.6462	1179.8836	(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	446.2224	353.6783	279.5733	142.0919	45.4514	0.0000	0.0000	0.0000	0.0000	124.3568	290.0936	455.7201	(98)
Space heating												2137.1877	(98)
RHI space heating demand												2137	(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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15847.9400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss			(33) + (36) =	54.3873			(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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	90.7390	90.5029	90.2715	89.1846	88.9812	88.0345	88.0345	87.8592	88.3992	88.9812	89.3926	89.8227 (39)
Average = Sum(39)m / 12 =												89.1836 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2389	1.2357	1.2325	1.2177	1.2149	1.2020	1.2020	1.1996	1.2070	1.2149	1.2205	1.2264 (40)
HLP (average)												1.2177 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (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 =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)	
								Total per year (kWh/year) = Sum(64)m =					1570.8557 (64)
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(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				3.5800	19.6403	0.4400		0.0000	0.7700		23.8218 (76)	
South				1.7900	46.7521	0.4400		0.0000	0.7700		28.3529 (78)	
West				3.2400	19.6403	0.4400		0.0000	0.7700		21.5594 (80)	
Solar gains	73.7340	135.2098	205.3495	280.0757	330.9776	334.5431	320.1761	282.3730	231.8253	155.4233	90.1927	61.8187 (83)
Total gains	600.7681	657.6543	707.0669	750.0137	768.6246	743.4308	712.4608	682.9879	650.9374	606.5190	576.6123	574.7250 (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	48.5150	48.6416	48.7663	49.3606	49.4734	50.0054	50.0054	50.1052	49.7992	49.4734	49.2457	49.0099
alpha	4.2343	4.2428	4.2511	4.2907	4.2982	4.3337	4.3337	4.3403	4.3199	4.2982	4.2830	4.2673
util living area	0.9879	0.9809	0.9651	0.9250	0.8399	0.6864	0.5253	0.5654	0.7847	0.9373	0.9796	0.9899 (86)
MIT	19.7009	19.8549	20.1159	20.4546	20.7424	20.9246	20.9814	20.9744	20.8594	20.4945	20.0414	19.6718 (87)
Th 2	19.8890	19.8915	19.8941	19.9059	19.9081	19.9184	19.9184	19.9203	19.9144	19.9081	19.9036	19.8989 (88)
util rest of house	0.9845	0.9756	0.9549	0.9020	0.7900	0.5954	0.4049	0.4448	0.7059	0.9132	0.9730	0.9870 (89)
MIT 2	18.1901	18.4144	18.7905	19.2736	19.6526	19.8653	19.9108	19.9088	19.8012	19.3390	18.6947	18.1548 (90)
Living area fraction	18.4624	18.6740	19.0294	19.4865	19.8490	20.0562	20.1038	20.1009	19.9919	19.5473	18.9374	18.4282 (91)
MIT	18.4624	18.6740	19.0294	19.4865	19.8490	20.0562	20.1038	20.1009	19.9919	19.5473	18.9374	18.4282 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3124	18.5240	18.8794	19.3365	19.6990	19.9062	19.9538	19.9509	19.8419	19.3973	18.7874	18.2782 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9775	0.9663	0.9423	0.8871	0.7788	0.5943	0.4090	0.4484	0.6999	0.8985	0.9633	0.9808	(94)
Useful gains	587.2505	635.5123	666.2786	665.3187	598.6328	441.8321	291.4115	306.2398	455.5675	544.9742	555.4355	563.7175	(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	1271.4688	1233.0139	1117.5057	930.7710	711.7638	467.1292	295.2467	311.9782	507.5830	782.7909	1044.7676	1264.5441	(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	509.0585	401.5211	335.7130	191.1256	84.1695	0.0000	0.0000	0.0000	0.0000	176.9357	352.3191	521.4150	(98)
Space heating												2572.2574	(98)
Space heating per m2											(98) / (4) =	35.1209	(99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



Calculation of Energy Ratings 09 Jan 2014

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000 (201)
Fraction of space heat from main system(s)													1.0000 (202)
Efficiency of main space heating system 1 (in %)													90.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													2842.2734 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	509.0585	401.5211	335.7130	191.1256	84.1695	0.0000	0.0000	0.0000	0.0000	176.9357	352.3191	521.4150	(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)	562.4955	443.6697	370.9535	211.1885	93.0050	0.0000	0.0000	0.0000	0.0000	195.5090	389.3029	576.1492	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)
Efficiency of water heater (217)m	89.7141	89.6496	89.5075	89.1873	88.5661	87.3000	87.3000	87.3000	87.3000	89.0979	89.5495	89.7453	(216) (217)
Fuel for water heating, kWh/month	178.1835	156.3796	162.6576	143.7865	140.0331	124.2327	116.7468	131.6541	132.5400	149.3837	160.3517	172.9850	(219)
Water heating fuel used												1768.9343	(219)
Annual totals kWh/year													
Space heating fuel - main system												2842.2734	(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)												359.4216	(232)
Total delivered energy for all uses												5045.6293	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost f/year
Space heating - main system 1	2842.2734	3.4800	98.9111 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1768.9343	3.4800	61.5589 (247)
Pumps and fans for heating	75.0000	13.1900	9.8925 (249)
Energy for lighting	359.4216	13.1900	47.4077 (250)
Additional standing charges			120.0000 (251)
Total energy cost			337.7702 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):	0.4200 (256)
Energy cost factor (ECF)	1.1998 (257)
SAP value	83.2629
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	2842.2734	0.2160	613.9311 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1768.9343	0.2160	382.0898 (264)
Space and water heating			996.0209 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Total kg/year			1221.4857 (272)
CO2 emissions per m2			16.6800 (273)
EI value			86.1570
EI rating			86 (274)
EI band			B

Calculation of stars for heating and DHW

Main heating energy efficiency	$3.48 \times (1 + 0.29 \times 0.00) / 0.9050 = 3.845$, stars = 4
Main heating environmental impact	$0.216 \times (1 + 0.29 \times 0.00) / 0.9050 = 0.2387$, stars = 4
Water heating energy efficiency	$3.48 / 0.8868 = 3.924$, stars = 4
Water heating environmental impact	$0.216 / 0.8868 = 0.2436$, 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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) =		0.3515 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.2000	4.0000	4.0000	3.7000	3.7000	3.3000	3.4000	3.2000	3.3000	3.5000	3.5000	3.8000 (22)
Wind factor	1.0500	1.0000	1.0000	0.9250	0.9250	0.8250	0.8500	0.8000	0.8250	0.8750	0.8750	0.9500 (22a)
Adj infilt rate												
Effective ac	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15847.9400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K				216.3837			(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)				8.1216			(36)
Total fabric heat loss			(33) + (36) =	54.3873			(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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	88.7825	88.3992	88.3992	87.8592	87.8592	87.2047	87.3614	87.0528	87.2047	87.5226	87.5226	88.0345 (39)
Average = Sum(39)m / 12 =												87.7669 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2122	1.2070	1.2070	1.1996	1.1996	1.1907	1.1928	1.1886	1.1907	1.1950	1.1950	1.2020 (40)
HLP (average)												1.1983 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (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 =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (64)	
	Total per year (kWh/year) = Sum(64)m =											1570.8557 (64)	
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(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				3.5800	22.3313	0.4400	0.0000	0.7700	27.0857 (76)				
South				1.7900	50.9848	0.4400	0.0000	0.7700	30.9198 (78)				
West				3.2400	22.3313	0.4400	0.0000	0.7700	24.5134 (80)				
Solar gains	82.5189	136.2413	204.5274	287.6917	331.4986	358.7556	339.5613	306.0059	250.3482	167.2550	103.4275	68.5036	(83)
Total gains	609.5531	658.6858	706.2448	757.6297	769.1456	767.6433	731.8460	706.6208	669.4603	618.3507	589.8470	581.4098	(84)

7. Mean internal temperature (heating season)

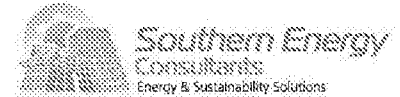
Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
tau	49.5841	49.7992	49.7992	50.1052	50.1052	50.4813	50.3908	50.5694	50.4813	50.2979	50.2979	50.0054
alpha	4.3056	4.3199	4.3199	4.3403	4.3403	4.3654	4.3594	4.3713	4.3654	4.3532	4.3532	4.3337
util living area	0.9845	0.9771	0.9560	0.8993	0.7744	0.5462	0.3670	0.3901	0.6857	0.9085	0.9716	0.9869 (86)
MIT	19.8502	19.9820	20.2524	20.5825	20.8477	20.9762	20.9968	20.9959	20.9335	20.6290	20.1971	19.8273 (87)
Th 2	19.9102	19.9144	19.9144	19.9203	19.9203	19.9275	19.9258	19.9291	19.9275	19.9240	19.9240	19.9184 (88)
util rest of house	0.9801	0.9705	0.9427	0.8683	0.7070	0.4388	0.2414	0.2617	0.5850	0.8732	0.9619	0.9831 (89)
MIT 2	18.4213	18.6137	18.9994	19.4573	19.7867	19.9157	19.9252	19.9283	19.8845	19.5313	18.9323	18.3942 (90)
Living area fraction	18.6788	18.8603	19.2252	19.6601	19.9779	20.1068	20.1183	20.1207	20.0736	19.7291	19.1603	18.6525 (91)
MIT	18.5288	18.7103	19.0752	19.5101	19.8279	19.9568	19.9683	19.9707	19.9236	19.5791	19.0103	18.5025 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5288	18.7103	19.0752	19.5101	19.8279	19.9568	19.9683	19.9707	19.9236	19.5791	19.0103	18.5025 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9720	0.9605	0.9293	0.8540	0.7005	0.4418	0.2465	0.2668	0.5846	0.8591	0.9507	0.9758	(94)
Useful gains	592.4858	632.6356	656.3078	646.9836	538.8065	339.1806	180.3852	188.5327	391.3813	531.2092	560.7384	567.3566	(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	1192.2470	1158.9426	1032.0783	844.3334	599.8971	345.0505	180.6912	188.9670	411.9177	698.3555	963.6462	1179.8836	(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	446.2224	353.6783	279.5733	142.0919	45.4514	0.0000	0.0000	0.0000	0.0000	124.3568	290.0936	455.7201	(98)
Space heating												2137.1877	(98)
Space heating per m2												29.1806	(99)
										(98) / (4) =			

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)													0.0000	(201)
Fraction of space heat from main system(s)													1.0000	(202)
Efficiency of main space heating system 1 (in %)													90.5000	(206)
Efficiency of secondary/supplementary heating system, %													0.0000	(208)
Space heating requirement													2361.5334	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
Space heating requirement	446.2224	353.6783	279.5733	142.0919	45.4514	0.0000	0.0000	0.0000	0.0000	124.3568	290.0936	455.7201	(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)	493.0634	390.8048	308.9207	157.0076	50.2226	0.0000	0.0000	0.0000	0.0000	137.4108	320.5454	503.5581	(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	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459	(64)	
Efficiency of water heater (217)m	89.6334	89.5680	89.3781	88.9532	88.1358	87.3000	87.3000	87.3000	87.3000	88.8169	89.4148	89.6649	(216)	
Fuel for water heating, kWh/month	178.3440	156.5220	162.8931	144.1648	140.7167	124.2327	116.7468	131.6541	132.5400	149.8563	160.5933	173.1402	(219)	
Water heating fuel used												1771.4039	(219)	
Annual totals kWh/year														
Space heating fuel - main system													2361.5334	(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)													359.4216	(232)
Total delivered energy for all uses													4567.3589	(238)

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

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2361.5334	3.8700	91.3913 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1771.4039	3.8700	68.5533 (247)
Pumps and fans for heating	75.0000	18.9000	14.1750 (249)
Energy for lighting	359.4216	18.9000	67.9307 (250)
Additional standing charges			93.0000 (251)
Total energy cost			335.0504 (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	2361.5334	0.2160	510.0912 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1771.4039	0.2160	382.6232 (264)
Space and water heating			892.7145 (265)
Pumps and fans	75.0000	0.5190	38.9250 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Total kg/year			1118.1793 (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	2361.5334	1.2200	2881.0708 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	1771.4039	1.2200	2161.1128 (264)
Space and water heating			5042.1835 (265)
Pumps and fans	75.0000	3.0700	230.2500 (267)
Energy for lighting	359.4216	3.0700	1103.4242 (268)
Primary energy kWh/year			6375.8577 (272)
Primary energy kWh/m2/year			87.0543 (273)

SAP 2012 EPC IMPROVEMENTS

Current energy efficiency rating: B 83
Current environmental impact rating: B 86

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)

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

(For testing purposes):

A	Not considered
B	Not considered
C	Not considered
D	Not considered
E Low energy lighting	Already installed
F	Not considered
G	Not considered
H	Not considered
I	Not considered
J	Not considered
K	Not considered
M	Not considered
N Solar water heating	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	-177 kg (15.9%)
U Solar photovoltaic panels	+ 11.3	-£ 345	-947 kg (100.6%)

Recommended measures	Typical annual savings	Energy efficiency	Environmental impact
Solar water heating	£27	2.42 kg/m²	B 85 B 88
Solar photovoltaic panels	£345	12.93 kg/m²	A 96 A 98
Total Savings	£372	15.35 kg/m²	

Potential energy efficiency rating: A 96
Potential environmental impact rating: A 98

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	£82	£92	-£9
Mains gas	£253	£217	£36
Space heating	£199	£199	£0
Water heating	£69	£42	£27
Lighting	£68	£68	£0
Generated (PV)	-£0	-£345	£345

Total cost of fuels	£335	-£36	£372
Total cost of uses	£336	-£36	£372
Delivered energy	62 kWh/m²	25 kWh/m²	37 kWh/m²
Carbon dioxide emissions	1.1 tonnes	0.0 tonnes	1.1 tonnes
CO2 emissions per m²	15 kg/m²	0 kg/m²	15 kg/m²
Primary energy	87 kWh/m²	-3 kWh/m²	90 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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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)	=	0.3515 (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	0.4481	0.4394	0.4306	0.3866	0.3779	0.3339	0.3339	0.3251	0.3515	0.3779	0.3954	0.4139 (22b)
Effective ac	0.6004	0.5965	0.5927	0.5747	0.5714	0.5557	0.5557	0.5529	0.5618	0.5714	0.5782	0.5853 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =	46.2657			(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum(A x k)			(28)...(30) + (32) + (32a)...(32e) =	15847.9400			(34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss			(33) + (36) =	54.3873			(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	36.3517	36.1156	35.8842	34.7973	34.5939	33.6472	33.6472	33.4719	34.0119	34.5939	35.0053	35.4354 (38)
Heat transfer coeff	90.7390	90.5029	90.2715	89.1846	88.9812	88.0345	88.0345	87.8592	88.3992	88.9812	89.3926	89.8227 (39)
Average = Sum(39)m / 12 =												89.1836 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2389	1.2357	1.2325	1.2177	1.2149	1.2020	1.2020	1.1996	1.2070	1.2149	1.2205	1.2264 (40)
HLP (average)												1.2177 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (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 =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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												1.2900 (H8)	
Utilisation factor												0.5394 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												89.3510 (H14)	
Volume ratio Veff/V												0.8394 (H15)	
Solar storage volume factor												0.9650 (H16)	
Solar input												-830.0107 (H17)	
Solar input	-24.0687	-40.1637	-68.4033	-91.6739	-113.2554	-111.3481	-109.8766	-95.9997	-75.1871	-51.3439	-28.5489	-20.1414 (63)	
	Solar input (sum of months) = Sum(63)m =											-830.0107 (63)	
Output from w/h	135.7871	100.0300	77.1875	36.5653	10.7664	0.0000	0.0000	18.9342	40.5203	81.7539	115.0453	135.1045 (64)	
	Total per year (kWh/year) = Sum(64)m =											751.6946 (64)	
Heat gains from water heating, kWh/month	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(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	3.5800	19.6403	0.4400	0.0000	0.7700	23.8218 (76)
South	1.7900	46.7521	0.4400	0.0000	0.7700	28.3529 (78)
West	3.2400	19.6403	0.4400	0.0000	0.7700	21.5594 (80)

Solar gains	73.7340	135.2098	205.3495	280.0757	330.9776	334.5431	320.1761	282.3730	231.8253	155.4233	90.1927	61.8187 (83)
Total gains	600.7681	657.6543	707.0669	750.0137	768.6246	743.4308	712.4608	682.9879	650.9374	606.5190	576.6123	574.7250 (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	48.5150	48.6416	48.7663	49.3606	49.4734	50.0054	50.0054	50.1052	49.7992	49.4734	49.2457	49.0099
alpha	4.2343	4.2428	4.2511	4.2907	4.2982	4.3337	4.3337	4.3403	4.3199	4.2982	4.2830	4.2673
util living area	0.9879	0.9809	0.9651	0.9250	0.8399	0.6864	0.5253	0.5654	0.7847	0.9373	0.9796	0.9899 (86)
MIT	19.7009	19.8549	20.1159	20.4546	20.7424	20.9246	20.9814	20.9744	20.8594	20.4945	20.0414	19.6716 (87)
Th 2	19.8890	19.8915	19.8941	19.9059	19.9081	19.9184	19.9184	19.9203	19.9144	19.9081	19.9036	19.8969 (88)
util rest of house	0.9845	0.9756	0.9549	0.9020	0.7900	0.5954	0.4049	0.4448	0.7059	0.9132	0.9730	0.9870 (89)
MIT 2	18.1901	18.4144	18.7905	19.2736	19.6526	19.8653	19.9108	19.9088	19.8012	19.3390	18.6947	18.1548 (90)
Living area fraction	fLA = Living area / (4) = 0.1802 (91)											
MIT	18.4624	18.6740	19.0294	19.4865	19.8490	20.0562	20.1038	20.1009	19.9919	19.5473	18.9374	18.4282 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.3124	18.5240	18.8794	19.3365	19.6990	19.9062	19.9538	19.9509	19.8419	19.3973	18.7874	18.2782 (93)

Southern Energy
Consultants
Energy & Sustainability Solutions

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year
Space heating - main system 1	2842.2734	0.2160	613.9311 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	839.1673	0.2160	181.2601 (264)
Space and water heating			795.1912 (265)
Pumps and fans	125.0000	0.5190	64.8750 (267)
Energy for lighting	359.4216	0.5190	186.5398 (268)
Energy saving/generation technologies			
PV Unit	-1727.2394	0.5190	-896.4372 (269)
Total kg/year			150.1688 (272)
CO2 emissions per m2			2.0500 (273)
EI value			98.2982
EI rating			9B (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	36.6200 (1b)	x 2.3500 (2b)	= 86.0570 (1b) - (3b)
First floor	36.6200 (1c)	x 2.6600 (2c)	= 97.4092 (1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.2400		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 183.4662 (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) = 0.1635 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.4135 (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) = 0.3515 (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	0.3691	0.3515	0.3515	0.3251	0.3251	0.2900	0.2988	0.2812	0.2900	0.3076	0.3076	0.3339 (22b)
Effective ac	0.5681	0.5618	0.5618	0.5529	0.5529	0.5420	0.5446	0.5395	0.5420	0.5473	0.5473	0.5557 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
Opening Type 1			2.1500	1.4000	3.0100		(26)
Opening Type 2 (Uw = 1.30)			8.6100	1.2357	10.6397		(27)
Opening Type 3			2.1500	1.6000	3.4400		(26a)
Heat Loss Floor 1			36.6200	0.1900	6.9578	75.0000	2746.5000 (28a)
Brick Cavity	85.6700	12.9100	72.7600	0.2500	18.1900	60.0000	4365.6000 (29a)
External Roof 1	36.6200		36.6200	0.1100	4.0282	9.0000	329.5800 (30)
Total net area of external elements Aum (A, m ²)			158.9100				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	46.2657		(33)
Party Wall 1			39.9700	0.0000	0.0000	110.0000	4396.7000 (32)
Internal Wall 1			119.6100			9.0000	1076.4900 (32c)
Internal Wall 2			21.5300			75.0000	1614.7500 (32c)
Internal Floor 1			36.6200			18.0000	659.1600 (32d)
Internal Ceiling 1			36.6200			18.0000	659.1600 (32e)
Heat capacity Cm = Sum (A x k)							(28)...(30) + (32) + (32a)...(32e) = 15847.9400 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							216.3837 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.1216 (36)
Total fabric heat loss							(33) + (36) = 54.3873 (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	34.3952	34.0119	34.0119	33.4719	33.4719	32.8174	32.9740	32.6655	32.8174	33.1353	33.1353	33.6472 (38)
Heat transfer coeff	88.7825	88.3992	88.3992	87.8592	87.8592	87.2047	87.3614	87.0528	87.2047	87.5226	87.5226	88.0345 (39)
Average = Sum(39)m / 12 =												87.7669 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	1.2122	1.2070	1.2070	1.1996	1.1996	1.1907	1.1928	1.1886	1.1907	1.1950	1.1950	1.2020 (40)
HLP (average)												1.1983 (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												2.3221 (42)
Average daily hot water use (litres/day)												89.3510 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	98.2861	94.7120	91.1380	87.5640	83.9899	80.4159	80.4159	83.9899	87.5640	91.1380	94.7120	98.2861 (44)
Energy conte	145.7554	127.4786	131.5465	114.6854	110.0434	94.9591	87.9936	100.9739	102.1798	119.0808	129.9860	141.1563 (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 =	1405.8389 (45)
Distribution loss (46)m = 0.15 x (45)m													
	21.8633	19.1218	19.7320	17.2028	16.5065	14.2439	13.1990	15.1461	15.3270	17.8621	19.4979	21.1735 (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	14.1004	12.7151	14.0443	13.5538	13.9784	13.4961	13.9264	13.9601	13.5275	14.0170	13.6083	14.0895 (61)	
Total heat required for water heating calculated for each month													
	159.8558	140.1937	145.5908	128.2393	124.0218	108.4552	101.9199	114.9340	115.7074	133.0978	143.5942	155.2459 (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												1.3624 (H8)	
Utilisation factor												0.5200 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												89.3510 (H14)	
Volume ratio Veff/V												0.8394 (H15)	
Solar storage volume factor												0.9650 (H16)	
Solar input												-845.1092 (H17)	
Solar input	-26.0120	-39.0960	-65.8427	-91.0148	-109.6124	-115.3623	-112.5922	-100.5455	-78.4761	-53.3858	-31.6183	-21.5511 (63)	
	Solar input (sum of months) = Sum(63)m =											-845.1092 (63)	
Output from w/h													
	133.8438	101.0976	79.7481	37.2245	14.4094	0.0000	0.0000	14.3885	37.2313	79.7119	111.9759	133.6947 (64)	
	Total per year (kWh/year) = Sum(64)m =											743.3258 (64)	
Heat gains from water heating, kWh/month													
	51.9888	45.5654	47.2503	41.5214	40.0840	34.9479	32.7395	37.0638	37.3567	43.0986	46.6224	50.4569 (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	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	139.3288	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	50.8798	45.1910	36.7518	27.8235	20.7984	17.5589	18.9730	24.6618	33.1010	42.0293	49.0544	52.2940	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	305.5789	308.7499	300.7592	283.7479	262.2743	242.0921	228.6091	225.4382	233.4289	250.4401	271.9138	292.0960	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	51.2550	(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)	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	-92.8859	(71)
Water heating gains (Table 5)	69.8774	67.8057	63.5085	57.6686	53.8764	48.5388	44.0046	49.8170	51.8843	57.9282	64.7533	67.8184	(72)
Total internal gains	527.0341	522.4445	501.7174	469.9379	437.6470	408.8877	392.2847	400.6149	419.1121	451.0957	486.4195	512.9063	(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	3.5800	22.3313	0.4400	0.0000	0.7700	27.0857 (76)
South	1.7900	50.9848	0.4400	0.0000	0.7700	30.9198 (78)
West	3.2400	22.3313	0.4400	0.0000	0.7700	24.5134 (80)

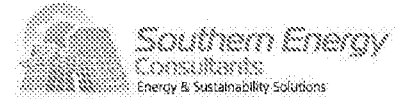
Solar gains	82.5189	136.2413	204.5274	287.6917	331.4986	358.7556	339.5613	306.0059	250.3482	167.2550	103.4275	68.5036 (83)
Total gains	609.5531	658.6858	706.2448	757.6297	769.1456	767.6433	731.8460	706.6208	669.4603	618.3507	589.8470	581.4098 (84)

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	49.5841	49.7992	49.7992	50.1052	50.1052	50.4813	50.3908	50.5694	50.4813	50.2979	50.2979	50.0054
alpha	4.3056	4.3199	4.3199	4.3403	4.3403	4.3654	4.3594	4.3713	4.3654	4.3532	4.3532	4.3337
util living area	0.9845	0.9771	0.9560	0.8993	0.7744	0.5462	0.3670	0.3901	0.6857	0.9085	0.9716	0.9869 (86)
MIT	19.8502	19.9820	20.2524	20.5825	20.8477	20.9762	20.9968	20.9959	20.9335	20.6290	20.1971	19.8273 (87)
Th 2	19.9102	19.9144	19.9144	19.9203	19.9203	19.9275	19.9258	19.9291	19.9275	19.9240	19.9240	19.9184 (88)
util rest of house	0.9801	0.9705	0.9427	0.8683	0.7070	0.4388	0.2414	0.2617	0.5850	0.8732	0.9619	0.9831 (89)
MIT 2	18.4213	18.6137	18.9994	19.4573	19.7867	19.9157	19.9252	19.9283	19.8845	19.5313	18.9323	18.3942 (90)
Living area fraction	fLA = Living area / (4) =											0.1802 (91)
MIT	18.6788	18.8603	19.2252	19.6601	19.9779	20.1068	20.1183	20.1207	20.0736	19.7291	19.1603	18.6525 (92)
Temperature adjustment												-0.1500
adjusted MIT	18.5288	18.7103	19.0752	19.5101	19.8279	19.9568	19.9683	19.9707	19.9236	19.5791	19.0103	18.5025 (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	0.9720	0.9605	0.9293	0.8540	0.7005	0.4418	0.2465	0.2668	0.5846	0.8591	0.9507	0.9758	(94)
Useful gains	592.4858	632.6356	656.3078	646.9836	538.8065	339.1806	180.3852	188.5327	391.3813	531.2092	560.7384	567.3566	(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	1192.2470	1158.9426	1032.0783	844.3334	599.8971	345.0505	180.6912	188.9670	411.9177	698.3555	963.6462	1179.8836	(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	446.2224	353.6783	279.5733	142.0919	45.4514	0.0000	0.0000	0.0000	0.0000	124.3568	290.0936	455.7201	(98)
Space heating												2137.1877	(98)
Space heating per m2												29.1806	(99)
												(98) / (4) =	

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													2361.5334 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	446.2224	353.6783	279.5733	142.0919	45.4514	0.0000	0.0000	0.0000	0.0000	124.3568	290.0936	455.7201	(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)	493.0634	390.8048	308.9207	157.0076	50.2226	0.0000	0.0000	0.0000	0.0000	137.4108	320.5454	503.5581	(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	133.8438	101.0976	79.7481	37.2245	14.4094	0.0000	0.0000	14.3885	37.2313	79.7119	111.9759	133.6947	(64)
Efficiency of water heater	89.7410	89.7685	89.7697	89.8166	89.7085	87.3000	87.3000	87.3000	87.3000	89.2225	89.5855	89.7538	(217)
Fuel for water heating, kWh/month	149.1445	112.6204	88.8363	41.4450	16.0625	0.0000	0.0000	16.4817	42.6475	89.3406	124.9934	148.9573	(219)
Water heating fuel used												830.5292	(219)
Annual totals kWh/year													
Space heating fuel - main system												2361.5334	(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)												359.4216	(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												1852.3245	(238)

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

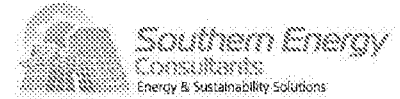
	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2361.5334	3.8700	91.3913	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	830.5292	3.8700	32.1415	(247)
Pumps and fans for heating	75.0000	18.9000	14.1750	(249)
Pump for solar water heating	50.0000	18.9000	9.4500	(249)
Energy for lighting	359.4216	18.9000	67.9307	(250)
Additional standing charges			93.0000	(251)
Energy saving/generation technologies				
PV Unit	-1824.1596	18.9000	-344.7662	(252)
Total energy cost			-36.6777	(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	2361.5334	0.2160	510.0912	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	830.5292	0.2160	179.3943	(264)
Space and water heating			689.4855	(265)
Pumps and fans	125.0000	0.5190	64.8750	(267)
Energy for lighting	359.4216	0.5190	186.5398	(268)
Energy saving/generation technologies				
PV Unit	-1824.1596	0.5190	-946.7389	(269)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Total kg/year -5.8385 (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	2361.5334	1.2200	2881.0708 (261)
Space heating - secondary	0.0000	0.0000	0.0000 (263)
Water heating (other fuel)	830.5292	1.2200	1013.2456 (264)
Space and water heating			3894.3164 (265)
Pumps and fans	125.0000	3.0700	383.7500 (267)
Energy for lighting	359.4216	3.0700	1103.4242 (268)
Energy saving/generation technologies			
PV Unit	-1824.1596	3.0700	-5600.1701 (269)
Primary energy kWh/year			-218.6795 (272)
Primary energy kWh/m2/year			-2.9858 (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	216.4 (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	242.18 (P1)
Transmission heat loss coefficient	54.39 (37)
Summer heat loss coefficient	296.56 (P2)

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

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

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data g or Table 6b	FF Specific data or Table 6c	Shading	Gains W
East	3.5800	117.5071	0.4400	0.0000	0.9000	166.5874
South	1.7900	112.2060	0.4400	0.0000	0.9000	79.5361
West	3.2400	117.5071	0.4400	0.0000	0.9000	150.7663

total: 396.8898

	Jun	Jul	Aug	
Solar gains	419	397	358	(P4)
Internal gains	406	389	398	
Total summer gains	825	786	755	(P5)

Summer gain/loss ratio	2.78	2.65	2.55	(P6)
Summer external temperature	16.00	17.90	17.80	
Thermal mass temperature increment (TMP = 216.4)	0.49	0.49	0.49	
Threshold temperature	19.27	21.04	20.83	(P7)
Likelihood of high internal temperature	Not significant	Slight	Slight	

Assessment of likelihood of high internal temperature: Slight