



ENERGYREPORT

building certification | compliance | testing

Energy Statement

Project:

259 Winchester Road, Chandlers
Ford

Client:

Blaze Construction

Project Reference:

J02384

Date:

7th December 2023

259 Winchester Road, Chandlers Ford, Eastleigh

This report identifies a solution in order to comply with Planning Condition 05 of planning application no. F/22/92694– 259 Winchester Road, Chandlers Ford.

A 19% improvement in predicted carbon emissions, compared with the building regulations, through increased energy efficiency of the building fabric
Reason: To ensure an adaptable and sustainable dwelling

SAP Ratings have been calculated as instructed in accordance with Approved Document L1 2021

	CO2 Emissions (Tonnes/yr)		
	Part L Compliant	Proposed	% reduction
Total	7.24	3.26	54.9%

Notes

The SAP Calculations are based on the drawings/specification supplied

Appendix

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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Property Reference	J02384 259 Winchester Road Design				Issued on Date	06/12/2023
Assessment Reference		Prop Type Ref	As designed			
Property	259, Winchester Road, SO53 2DX					
SAP Rating	86 B	DER	12.17	TER	19.61	
Environmental	87 B	% DER<TER	37.94			
CO ₂ Emissions (t/year)	2.71	DFEE	40.55	TFEE	51.90	
General Requirements Compliance	Pass	% DFEE<TFEE	21.87			
Assessor Details	Mr. Stephen Harrison, Tel: 01489883231, Greendeal1975@gmail.com				Assessor ID	w557-0001
Client	Blaze Construction					

FULL SAP CALCULATION PRINTOUT

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

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

DWELLING AS DESIGNED

Detached House, total floor area 276 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:Electricity
Fuel factor:1.55 (electricity)

Target Carbon Dioxide Emission Rate (TER) 19.61 kgCO₂/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.17 kgCO₂/m²OK

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)51.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)40.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.17 (max. 0.30)	0.17 (max. 0.70)	OK
Floor	0.12 (max. 0.25)	0.12 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.12 (max. 0.35)	OK
Openings	0.81 (max. 2.00)	1.00 (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:	4.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system: Heat pump with radiators or underfloor - Electric
LG THERMA V HU071 U42 + HN0914 NK2

Secondary heating system: None

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 2.00 kWh/day	
Permitted by DBSCG 2.86	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
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Hot water controls:

Cylinderstat	OK
Independent timer for DHW	OK

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

9 Summertime temperature

Overheating risk (Southern England):	Not significant	OK
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Based on:

Overshading:	Average
Windows facing North East:	19.59 m ² , No overhang
Windows facing South East:	2.88 m ² , No overhang
Windows facing South West:	8.28 m ² , No overhang
Windows facing North West:	0.81 m ² , No overhang
Air change rate:	5.00 ach
Blinds/curtains:	None

10 Key features

Roof U-value	0.07 W/m ² K
Roof U-value	0.12 W/m ² K
Floor U-value	0.12 W/m ² K
Door U-value	1.00 W/m ² K
Window U-value	0.80 W/m ² K
Roof window U-value	0.80 W/m ² K

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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					6 * 10 = 60.0000 (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) =					Air changes per hour 60.0000 / (5) = 0.0846 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2846 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2846 (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	0.3629	0.3557	0.3486	0.3130	0.3059	0.2704	0.2704	0.2632	0.2846	0.3059	0.3202	0.3344 (22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5513	0.5559 (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
Glazing (Uw = 0.80)			31.5600	0.7752	24.4651		(27)
Door			2.8100	1.0000	2.8100		(26)
Roof window (Uw = 0.80)			4.8600	0.7752	3.7674		(27a)
Heat Loss Floor 1			121.0000	0.1200	14.5200		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1700	33.2231		(29a)
External Roof 1	35.0000		35.0000	0.0700	2.4500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1200	9.1536		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	90.3893		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.9106 (36)
Total fabric heat loss						(33) + (36) =	120.2999 (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	132.4435	131.8452	131.2587	128.5039	127.9885	125.5891	125.5891	125.1448	126.5133	127.9885	129.0311	130.1212 (38)
Heat transfer coeff	252.7434	252.1450	251.5585	248.8037	248.2883	245.8890	245.8890	245.4447	246.8132	248.2883	249.3310	250.4211 (39)
Average = Sum(39)m / 12 =												248.8013 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9157	0.9136	0.9114	0.9015	0.8996	0.8909	0.8909	0.8893	0.8943	0.8996	0.9034	0.9073 (40)
HLP (average)												0.9015 (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	3.1007 (42)
Average daily hot water use (litres/day)	107.8423 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy conte	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Energy content (annual)										Total = Sum(45)m =		1696.7799 (45)
Distribution loss (46)m = 0.15 x (45)m												
	26.3880	23.0791	23.8155	20.7630	19.9226	17.1917	15.9306	18.2806	18.4989	21.5587	23.5330	25.5553 (46)
Water storage loss:												

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ENERGYREPORT
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800		(56)
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800		(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624		(59)
Total heat required for water heating calculated for each month													
232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113		(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 =													(63)
Output from w/h													
232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113		(64)
Heat gains from water heating, kWh/month													
103.8872	92.1596	98.1851	89.9542	89.5556	82.0378	80.7067	85.9159	84.9355	93.1824	96.0945	102.0416		(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	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
42.2382	37.5156	30.5097	23.0978	17.2659	14.5766	15.7505	20.4731	27.4790	34.8909	40.7229	43.4121		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
438.5268	443.0773	431.6101	407.1978	376.3816	347.4188	328.0698	323.5193	334.9865	359.3988	390.2150	419.1778		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036		(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		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292		(71)
Water heating gains (Table 5)													
139.6334	137.1423	131.9692	124.9364	120.3704	113.9414	108.4768	115.4784	117.9660	125.2452	133.4645	137.1527		(72)
Total internal gains													
689.9093	687.2461	663.6000	624.7430	583.5289	545.4477	521.8081	528.9817	549.9425	589.0458	633.9133	669.2536		(73)

6. Solar gains

[Jan]													
Area													
m2													
Solar flux													
Table 6a													
W/m2													
Specific data													
or Table 6b													
Specific data													
or Table 6c													
Access													
factor													
Table 6d													
Gains													
W													
Northeast	19.5900	11.2829	0.6300	0.7000	0.7700	67.5505	(75)						
Southeast	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(77)						
Southwest	8.2800	36.7938	0.6300	0.7000	0.7700	93.1059	(79)						
Northwest	0.8100	11.2829	0.6300	0.7000	0.7700	2.7931	(81)						
Northeast	2.4300	26.0000	0.6300	0.7000	1.0000	25.0761	(82)						
Southwest	2.4300	26.0000	0.6300	0.7000	1.0000	25.0761	(82)						
Solar gains	245.9864	461.1056	735.6254	1075.3975	1345.7553	1395.8986	1321.0432	1111.6741	852.8602	538.5416	302.4740	205.3475	(83)
Total gains	935.8957	1148.3518	1399.2253	1700.1405	1929.2842	1941.3462	1842.8513	1640.6558	1402.8027	1127.5874	936.3873	874.6010	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	75.8345	76.0145	76.1917	77.0353	77.1952	77.9485	77.9485	78.0896	77.6566	77.1952	76.8724	76.5378	
alpha	6.0556	6.0676	6.0794	6.1357	6.1463	6.1966	6.1966	6.2060	6.1771	6.1463	6.1248	6.1025	
util living area	0.9999	0.9997	0.9982	0.9867	0.9246	0.7570	0.5779	0.6655	0.9292	0.9965	0.9998	0.9999	(86)
Tweekday	18.8892	19.0361	19.2951	19.6570	19.9552	20.0910	20.1091	20.1077	20.0084	19.6118	19.1911	18.8749	
Tweekend	20.4048	20.4690	20.5828	20.7410	20.8806	20.9536	20.9687	20.9652	20.9024	20.7193	20.5343	20.3960	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	14	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.2872	20.1787	20.3562	20.5956	20.8157	20.9287	20.9517	20.9463	20.8476	20.5667	20.2729	20.0677	(87)
Th 2	20.1541	20.1560	20.1578	20.1663	20.1678	20.1752	20.1752	20.1766	20.1724	20.1678	20.1646	20.1613	(88)
util rest of house	0.9999	0.9995	0.9975	0.9812	0.8942	0.6800	0.4745	0.5578	0.8875	0.9946	0.9997	0.9999	(89)
Tweekday	18.8892	19.0361	19.2951	19.6570	19.9552	20.0910	20.1091	20.1077	20.0084	19.6118	19.1911	18.8749	
Tweekend	18.8892	19.0361	19.2951	19.6570	19.9552	20.0910	20.1091	20.1077	20.0084	19.6118	19.1911	18.8749	
MIT 2	18.8892	19.0361	19.2951	19.6570	19.9552	20.0910	20.1091	20.1077	20.0084	19.6118	19.1911	18.8749	(90)
Living area fraction									fLA = Living area / (4) =				
MIT	19.0189	19.1421	19.3935	19.7440	20.0351	20.1687	20.1872	20.1855	20.0862	19.7004	19.2914	18.9855	(91)
Temperature adjustment													
adjusted MIT	19.0189	19.1421	19.3935	19.7440	20.0351	20.1687	20.1872	20.1855	20.0862	19.7004	19.2914	18.9855	(92)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9998	0.9993	0.9966	0.9774	0.8884	0.6793	0.4760	0.5590	0.8820	0.9930	0.9995	0.9999	(94)
Useful gains	935.7313	1147.5782	1394.4159	1661.7405	1713.8934	1318.8053	877.2549	917.1142	1237.2159	1119.6512	935.9092	874.5010	(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													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fraction	3720.0974	3591.0718	3243.4683	2698.0337	2069.4964	1369.2829	882.0629	929.1380	1477.4759	2259.5267	3039.6984	3702.6025 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	2071.5684	1642.0277	1375.6950	746.1311	264.5687	0.0000	0.0000	0.0000	0.0000	848.0674	1514.7283	2104.1075 (98)
Space heating requirement												10566.8940 (98)
Space heating requirement per m2												(98) / (4) = 38.2858 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.0851 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												4242.2831 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	2071.5684	1642.0277	1375.6950	746.1311	264.5687	0.0000	0.0000	0.0000	0.0000	848.0674	1514.7283	2104.1075 (98)
Space heating efficiency (main heating system 1)	249.0851	249.0851	249.0851	249.0851	249.0851	0.0000	0.0000	0.0000	0.0000	249.0851	249.0851	249.0851 (210)
Space heating fuel (main heating system)	831.6710	659.2236	552.2992	299.5487	106.2162	0.0000	0.0000	0.0000	0.0000	340.4730	608.1168	844.7345 (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	232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113 (64)
Efficiency of water heater	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600 (216)
(217)m	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600 (217)
Fuel for water heating, kWh/month	145.7235	128.4678	134.9823	121.0897	118.7270	106.1775	102.0584	111.8709	111.6361	125.5588	132.6561	142.2468 (219)
Water heating fuel used												1481.1950 (219)
Annual totals kWh/year												
Space heating fuel - main system												4242.2831 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												745.9401 (232)
Electricity for lighting (calculated in Appendix L)												6469.4182 (238)
Total delivered energy for all uses												

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	4242.2831	0.5190	2201.7449 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1481.1950	0.5190	768.7402 (264)
Space and water heating			2970.4851 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	745.9401	0.5190	387.1429 (268)
Total CO2, kg/year			3357.6280 (272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.1700 (273)

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

DER		12.1700 ZC1
Total Floor Area	TFA	276.0000
Assumed number of occupants	N	3.1007
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190
CO2 emissions from appliances, equation (L14)		9.4153 ZC2
CO2 emissions from cooking, equation (L16)		0.7008 ZC3
Total CO2 emissions		22.2861 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		22.2861 ZC8

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.0564 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3064 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.3064 (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	0.3907	0.3830	0.3753	0.3370	0.3294	0.2911	0.2911	0.2834	0.3064	0.3294	0.3447	0.3600 (22b)
Effective ac	0.5763	0.5733	0.5704	0.5568	0.5542	0.5424	0.5424	0.5402	0.5469	0.5542	0.5594	0.5648 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.8100	1.0000	2.8100		(26)
TER Opening Type (Uw = 1.40)			31.5600	1.3258	41.8409		(27)
TER Room Window (Uw = 1.70)			4.8600	1.5918	7.7360		(27a)
Heat Loss Floor 1			121.0000	0.1300	15.7300		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1800	35.1774		(29a)
External Roof 1	35.0000		35.0000	0.1300	4.5500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1300	9.9164		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		117.7607		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.5496 (36)
Total fabric heat loss						(33) + (36) =	137.3103 (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	134.8950	134.2015	133.5216	130.3286	129.7312	126.9501	126.9501	126.4351	128.0214	129.7312	130.9397	132.2032 (38)
Heat transfer coeff	272.2053	271.5117	270.8319	267.6389	267.0414	264.2604	264.2604	263.7454	265.3316	267.0414	268.2500	269.5135 (39)
Average = Sum(39)m / 12 =												267.6360 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9863	0.9837	0.9813	0.9697	0.9675	0.9575	0.9575	0.9556	0.9613	0.9675	0.9719	0.9765 (40)
HLP (average)												0.9697 (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												3.1007 (42)
Average daily hot water use (litres/day)												107.8423 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy conte	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Energy content (annual)												Total = Sum(45)m = 1696.7799 (45)
Distribution loss (46)m = 0.15 x (45)m												
	26.3880	23.0791	23.8155	20.7630	19.9226	17.1917	15.9306	18.2806	18.4989	21.5587	23.5330	25.5553 (46)
Water storage loss:												



CALCULATION OF TARGET EMISSIONS 09 Jan 2014

store volume													300.0000	(47)	
a) If manufacturer declared loss factor is known (kWh/day):													2.1127	(48)	
Temperature factor from Table 2b													0.5400	(49)	
Enter (49) or (54) in (55)													1.1409	(55)	
Total storage loss															
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	34.2256	35.3664	(56)
If cylinder contains dedicated solar storage															
	35.3664	31.9439	35.3664	34.2256	35.3664	34.2256	35.3664	35.3664	34.2256	35.3664	34.2256	35.3664	34.2256	35.3664	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month															
	234.5486	206.8156	217.3991	195.1574	191.4459	171.3486	164.8328	180.4995	180.0637	202.3536	213.6244	228.9977	(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	(64)	
Output from w/h															
	234.5486	206.8156	217.3991	195.1574	191.4459	171.3486	164.8328	180.4995	180.0637	202.3536	213.6244	228.9977	(63)		
	Total per year (kWh/year) = Sum(64)m =												2387.0869	(64)	
Heat gains from water heating, kWh/month															
	105.3964	93.5227	99.6942	91.4146	91.0647	83.4982	82.2159	87.4250	86.3960	94.6915	97.5549	103.5507	(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	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.2382	37.5156	30.5097	23.0978	17.2659	14.5766	15.7505	20.4731	27.4790	34.8909	40.7229	43.4121 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.5268	443.0773	431.6101	407.1978	376.3816	347.4188	328.0698	323.5193	334.9865	359.3988	390.2150	419.1778 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036 (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)	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292 (71)
Water heating gains (Table 5)	141.6618	139.1707	133.9976	126.9648	122.3988	115.9698	110.5052	117.5068	119.9944	127.2736	135.4929	139.1811 (72)
Total internal gains	694.9377	692.2745	668.6284	629.7714	588.5573	550.4761	526.8365	534.0101	554.9709	594.0742	638.9417	674.2820 (73)

6. Solar gains

[Jan]											Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W
Northeast											19.5900	11.2829	0.6300	0.7000	0.7700	67.5505 (75)
Southeast											2.8800	36.7938	0.6300	0.7000	0.7700	32.3847 (77)
Southwest											8.2800	36.7938	0.6300	0.7000	0.7700	93.1059 (79)
Northwest											0.8100	11.2829	0.6300	0.7000	0.7700	2.7931 (81)
Northeast											2.4300	26.0000	0.6300	0.7000	1.0000	25.0761 (82)
Southwest											2.4300	26.0000	0.6300	0.7000	1.0000	25.0761 (82)
Solar gains	245.9864	461.1056	735.6254	1075.3975	1345.7553	1395.8986	1321.0432	1111.6741	852.8602	538.5416	302.4740	205.3475 (83)				
Total gains	940.9241	1153.3802	1404.2537	1705.1689	1934.3126	1946.3746	1847.8797	1645.6842	1407.8311	1132.6158	941.4157	879.6295 (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	70.4125	70.5924	70.7696	71.6139	71.7741	72.5295	72.5295	72.6711	72.2366	71.7741	71.4508	71.1158
alpha	5.6942	5.7062	5.7180	5.7743	5.7849	5.8353	5.8353	5.8447	5.8158	5.7849	5.7634	5.7411
util living area	0.9999	0.9996	0.9982	0.9882	0.9362	0.7876	0.6129	0.7000	0.9398	0.9967	0.9997	0.9999 (86)
MIT	19.7356	19.8707	20.1134	20.4535	20.7633	20.9442	20.9894	20.9784	20.8211	20.4198	20.0197	19.7181 (87)
Th 2	20.0948	20.0969	20.0990	20.1087	20.1105	20.1189	20.1189	20.1205	20.1157	20.1105	20.1068	20.1030 (88)
util rest of house	0.9999	0.9995	0.9975	0.9831	0.9082	0.7088	0.4986	0.5842	0.9011	0.9948	0.9996	0.9999 (89)
MIT 2	18.3695	18.5688	18.9254	19.4266	19.8583	20.0782	20.1146	20.1102	19.9466	19.3821	18.7943	18.3498 (90)
Living area fraction									fLA = Living area / (4) =			0.0928 (91)
MIT	18.4962	18.6895	19.0356	19.5219	19.9422	20.1585	20.1957	20.1908	20.0277	19.4783	18.9080	18.4767 (92)
Temperature adjustment												0.0000
adjusted MIT	18.4962	18.6895	19.0356	19.5219	19.9422	20.1585	20.1957	20.1908	20.0277	19.4783	18.9080	18.4767 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Utilisation	0.9998	0.9992	0.9962	0.9784	0.9017	0.7127	0.5090	0.5941	0.8961	0.9927	0.9994	0.9998 (94)
Useful gains	940.6956	1152.4157	1398.9509	1668.3497	1744.1114	1387.2415	940.5762	977.7508	1261.6029	1124.3188	940.8078	879.4875 (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	3864.2736	3744.0179	3395.0511	2842.8269	2201.0174	1468.9021	950.1993	999.7946	1572.8188	2370.8787	3167.4942	3847.7699 (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	2175.1421	1741.5567	1485.0986	845.6236	339.9380	0.0000	0.0000	0.0000	0.0000	927.4406	1603.2142	2208.4021 (98)
Space heating												11326.4158 (98)
Space heating per m2										(98) / (4) =		41.0377 (99)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF TARGET EMISSIONS 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 %)													93.5000 (206)
Efficiency of secondary/supplementary heating system, %													0.0000 (208)
Space heating requirement													12113.8137 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	2175.1421	1741.5567	1485.0986	845.6236	339.9380	0.0000	0.0000	0.0000	0.0000	927.4406	1603.2142	2208.4021	(98)
Space heating efficiency (main heating system 1)	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)	2326.3551	1862.6274	1588.3407	904.4102	363.5701	0.0000	0.0000	0.0000	0.0000	991.9151	1714.6676	2361.9274	(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	234.5486	206.8156	217.3991	195.1574	191.4459	171.3486	164.8328	180.4995	180.0637	202.3536	213.6244	228.9977	(64)
Efficiency of water heater (217)m	89.3341	89.2300	88.9766	88.2804	86.3296	79.8000	79.8000	79.8000	79.8000	88.3776	89.0953	79.8000	(216)
Fuel for water heating, kWh/month	262.5522	231.7781	244.3331	221.0653	221.7616	214.7226	206.5574	226.1898	225.6438	228.9649	239.7705	256.2238	(219)
Water heating fuel used												2779.5630	(219)
Annual totals kWh/year													
Space heating fuel - main system												12113.8137	(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)												745.9401	(232)
Total delivered energy for all uses												15714.3169	(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	12113.8137	0.2160	2616.5838	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2779.5630	0.2160	600.3856	(264)
Space and water heating			3216.9694	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	745.9401	0.5190	387.1429	(268)
Total CO2, kg/m2/year			3643.0373	(272)
Emissions per m2 for space and water heating			11.6557	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.4027	(272b)
Emissions per m2 for pumps and fans			0.1410	(272c)
Target Carbon Dioxide Emission Rate (TER) = (11.6557 * 1.55) + 1.4027 + 0.1410, rounded to 2 d.p.			19.6100	(273)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.0564 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2564 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2564 (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	0.3269	0.3205	0.3141	0.2820	0.2756	0.2436	0.2436	0.2372	0.2564	0.2756	0.2884	0.3013 (22b)
Effective ac	0.5534	0.5514	0.5493	0.5398	0.5380	0.5297	0.5297	0.5281	0.5329	0.5380	0.5416	0.5454 (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
Glazing (Uw = 0.80)			31.5600	0.7752	24.4651		(27)
Door			2.8100	1.0000	2.8100		(26)
Roof window (Uw = 0.80)			4.8600	0.7752	3.7674		(27a)
Heat Loss Floor 1			121.0000	0.1200	14.5200		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1700	33.2231		(29a)
External Roof 1	35.0000		35.0000	0.0700	2.4500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1200	9.1536		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3893		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.9106 (36)
Total fabric heat loss						(33) + (36) =	120.2999 (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	129.5414	129.0557	128.5797	126.3437	125.9254	123.9780	123.9780	123.6173	124.7281	125.9254	126.7717	127.6564 (38)
Heat transfer coeff	249.8412	249.3556	248.8795	246.6436	246.2252	244.2778	244.2778	243.9172	245.0279	246.2252	247.0715	247.9563 (39)
Average = Sum(39)m / 12 =												246.6416 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9052	0.9035	0.9017	0.8936	0.8921	0.8851	0.8851	0.8838	0.8878	0.8921	0.8952	0.8984 (40)
HLP (average)												0.8936 (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	3.1007 (42)
Average daily hot water use (litres/day)	107.8423 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy conte	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Energy content (annual)												Total = Sum(45)m = 1696.7799 (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:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	37.3830	32.6954	33.7387	29.4142	28.2236	24.3549	22.5683	25.8975	26.2068	30.5415	33.3384	36.2034	(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	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.2382	37.5156	30.5097	23.0978	17.2659	14.5766	15.7505	20.4731	27.4790	34.8909	40.7229	43.4121	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.5268	443.0773	431.6101	407.1978	376.3816	347.4188	328.0698	323.5193	334.9865	359.3988	390.2150	419.1778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	(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)	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	(71)
Water heating gains (Table 5)	50.2459	48.6538	45.3477	40.8531	37.9350	33.8262	30.3338	34.8085	36.3983	41.0504	46.3034	48.6605	(72)
Total internal gains	600.5219	598.7577	576.9785	540.6597	501.0935	465.3325	443.6651	448.3119	468.3748	504.8511	546.7522	580.7614	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W			
Northeast					19.5900	11.2829	0.6300		0.7000		0.7700		67.5505 (75)			
Southeast					2.8800	36.7938	0.6300		0.7000		0.7700		32.3847 (77)			
Southwest					8.2800	36.7938	0.6300		0.7000		0.7700		93.1059 (79)			
Northwest					0.8100	11.2829	0.6300		0.7000		0.7700		2.7931 (81)			
Northeast					2.4300	26.0000	0.6300		0.7000		1.0000		25.0761 (82)			
Southwest					2.4300	26.0000	0.6300		0.7000		1.0000		25.0761 (82)			
Solar gains					245.9864	461.1056	735.6254	1075.3975	1345.7553	1395.8986	1321.0432	1111.6741	852.8602	538.5416	302.4740	205.3475 (83)
Total gains					846.5082	1059.8633	1312.6039	1616.0572	1846.8487	1861.2311	1764.7083	1559.9859	1321.2350	1043.3926	849.2261	786.1089 (84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	76.7154	76.8648	77.0118	77.7100	77.8420	78.4626	78.4626	78.5786	78.2224	77.8420	77.5754	77.2986		
alpha	6.1144	6.1243	6.1341	6.1807	6.1895	6.2308	6.2308	6.2386	6.2148	6.1895	6.1717	6.1532		
util living area	1.0000	0.9998	0.9987	0.9895	0.9350	0.7767	0.5979	0.6908	0.9432	0.9977	0.9999	1.0000	(86)	
MIT	19.8155	19.9472	20.1811	20.5055	20.7990	20.9579	20.9930	20.9841	20.8412	20.4574	20.0775	19.7948	(87)	
Th 2	20.1631	20.1646	20.1660	20.1729	20.1742	20.1802	20.1802	20.1813	20.1779	20.1742	20.1716	20.1689	(88)	
util rest of house	0.9999	0.9997	0.9982	0.9851	0.9076	0.7009	0.4924	0.5819	0.9073	0.9964	0.9998	1.0000	(89)	
MIT 2	19.0530	19.1860	19.4208	19.7487	20.0277	20.1593	20.1782	20.1761	20.0741	19.7037	19.3221	19.0371	(90)	
Living area fraction									fLA = Living area / (4) =			0.0928	(91)	
MIT	19.1237	19.2566	19.4913	19.8189	20.0992	20.2334	20.2538	20.2511	20.1452	19.7736	19.3922	19.1074	(92)	
Temperature adjustment												0.0000		
adjusted MIT	19.1237	19.2566	19.4913	19.8189	20.0992	20.2334	20.2538	20.2511	20.1452	19.7736	19.3922	19.1074	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9999	0.9996	0.9976	0.9825	0.9046	0.7063	0.5022	0.5918	0.9055	0.9955	0.9997	0.9999	(94)
Ext temp.	846.4296	1059.4314	1309.5059	1587.8180	1670.6588	1314.5242	886.1840	923.1478	1196.3619	1038.6625	848.9912	786.0637	(95)
Heat loss rate W	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3703.5782	3579.8919	3233.2806	2693.0750	2068.0998	1376.1037	892.5387	939.3434	1481.2527	2258.7729	3037.0498	3696.3866	(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	(98a)
Space heating kWh	2125.7186	1693.7494	1431.2883	795.7850	295.6961	0.0000	0.0000	0.0000	0.0000	907.7621	1575.4022	2165.2802	(98)
Space heating												10990.6820	(98)
Space heating per m2												39.8213	(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	2296.2114	1807.6558	1853.7705	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8575	0.9258	0.8798	0.0000	0.0000	0.0000	0.0000	(101)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
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CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	1968.9381	1673.5380	1630.9270	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2273.9598	2160.6122	1935.8057	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	219.6156	362.3833	226.8297	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												808.8286 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	54.9039	90.5958	56.7074	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												202.2071 (107)
Space cooling per m2												0.7326 (108)
Energy for space heating												39.8213 (99)
Energy for space cooling												0.7326 (108)
Total												40.5539 (109)
Dwelling Fabric Energy Efficiency (DFEE)												40.6 (109)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					4 * 10 = 40.0000 (7a)
Number of passive vents					0 * 10 = 0.0000 (7b)
Number of flueless gas fires					0 * 40 = 0.0000 (7c)
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =					Air changes per hour 40.0000 / (5) = 0.0564 (8)
Pressure test					Yes
Measured/design AP50					5.0000
Infiltration rate					0.3064 (18)
Number of sides sheltered					0 (19)
Shelter factor					(20) = 1 - [0.075 x (19)] = 1.0000 (20)
Infiltration rate adjusted to include shelter factor					(21) = (18) x (20) = 0.3064 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	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	0.3907	0.3830	0.3753	0.3370	0.3294	0.2911	0.2911	0.2834	0.3064	0.3294	0.3447	0.3600 (22b)
Effective ac	0.5763	0.5733	0.5704	0.5568	0.5542	0.5424	0.5424	0.5402	0.5469	0.5542	0.5594	0.5648 (25)

3. Heat losses and heat loss parameter

Element	Gross m ²	Openings m ²	NetArea m ²	U-value W/m ² K	A x U W/K	K-value kJ/m ² K	A x K kJ/K
TER Opaque door			2.8100	1.0000	2.8100		(26)
TER Opening Type (Uw = 1.40)			31.5600	1.3258	41.8409		(27)
TER Room Window (Uw = 1.70)			4.8600	1.5918	7.7360		(27a)
Heat Loss Floor 1			121.0000	0.1300	15.7300		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1800	35.1774		(29a)
External Roof 1	35.0000		35.0000	0.1300	4.5500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1300	9.9164		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)					(26)...(30) + (32) = 117.7607		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.5496 (36)
Total fabric heat loss							(33) + (36) = 137.3103 (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
	134.8950	134.2015	133.5216	130.3286	129.7312	126.9501	126.9501	126.4351	128.0214	129.7312	130.9397	132.2032 (38)
Heat transfer coeff	272.2053	271.5117	270.8319	267.6389	267.0414	264.2604	264.2604	263.7454	265.3316	267.0414	268.2500	269.5135 (39)
Average = Sum(39)m / 12 =												267.6360 (39)

HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9863	0.9837	0.9813	0.9697	0.9675	0.9575	0.9575	0.9556	0.9613	0.9675	0.9719	0.9765 (40)
HLP (average)												0.9697 (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	3.1007 (42)
Average daily hot water use (litres/day)	107.8423 (43)

Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy conte	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Energy content (annual)										Total = Sum(45)m =		1696.7799 (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:												

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

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	37.3830	32.6954	33.7387	29.4142	28.2236	24.3549	22.5683	25.8975	26.2068	30.5415	33.3384	36.2034	(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	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	155.0365	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	42.2382	37.5156	30.5097	23.0978	17.2659	14.5766	15.7505	20.4731	27.4790	34.8909	40.7229	43.4121	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	438.5268	443.0773	431.6101	407.1978	376.3816	347.4188	328.0698	323.5193	334.9865	359.3988	390.2150	419.1778	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	38.5036	(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)	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	(71)
Water heating gains (Table 5)	50.2459	48.6538	45.3477	40.8531	37.9350	33.8262	30.3338	34.8085	36.3983	41.0504	46.3034	48.6605	(72)
Total internal gains	600.5219	598.7577	576.9785	540.6597	501.0935	465.3325	443.6651	448.3119	468.3748	504.8511	546.7522	580.7614	(73)

6. Solar gains

[Jan]					Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W		
Northeast		19.5900				11.2829	0.6300		0.7000		0.7700		67.5505 (75)		
Southeast		2.8800				36.7938	0.6300		0.7000		0.7700		32.3847 (77)		
Southwest		8.2800				36.7938	0.6300		0.7000		0.7700		93.1059 (79)		
Northwest		0.8100				11.2829	0.6300		0.7000		0.7700		2.7931 (81)		
Northeast		2.4300				26.0000	0.6300		0.7000		1.0000		25.0761 (82)		
Southwest		2.4300				26.0000	0.6300		0.7000		1.0000		25.0761 (82)		
Solar gains		245.9864	461.1056	735.6254	1075.3975	1345.7553	1395.8986	1321.0432	1111.6741	852.8602	538.5416	302.4740	205.3475	(83)	
Total gains		846.5082	1059.8633	1312.6039	1616.0572	1846.8487	1861.2311	1764.7083	1559.9859	1321.2350	1043.3926	849.2261	786.1089	(84)	

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	70.4125	70.5924	70.7696	71.6139	71.7741	72.5295	72.5295	72.6711	72.2366	71.7741	71.4508	71.1158		
alpha	5.6942	5.7062	5.7180	5.7743	5.7849	5.8353	5.8353	5.8447	5.8158	5.7849	5.7634	5.7411		
util living area	0.9999	0.9998	0.9987	0.9909	0.9466	0.8099	0.6380	0.7293	0.9532	0.9978	0.9998	1.0000	(86)	
MIT	19.7025	19.8379	20.0816	20.4240	20.7412	20.9352	20.9870	20.9733	20.7986	20.3889	19.9873	19.6852	(87)	
Th 2	20.0948	20.0969	20.0990	20.1087	20.1105	20.1189	20.1189	20.1205	20.1157	20.1105	20.1068	20.1030	(88)	
util rest of house	0.9999	0.9997	0.9982	0.9868	0.9220	0.7332	0.5209	0.6128	0.9208	0.9966	0.9998	1.0000	(89)	
MIT 2	18.8837	19.0208	19.2660	19.6143	19.9193	20.0859	20.1152	20.1116	19.9819	19.5826	19.1783	18.8731	(90)	
Living area fraction	18.9597	19.0966	19.3416	19.6894	19.9955	20.1646	20.1961	20.1915	20.0577	19.6573	19.2534	18.9485	(92)	
Temperature adjustment												0.0000		
adjusted MIT	18.9597	19.0966	19.3416	19.6894	19.9955	20.1646	20.1961	20.1915	20.0577	19.6573	19.2534	18.9485	(93)	

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	0.9999	0.9995	0.9976	0.9843	0.9181	0.7377	0.5317	0.6231	0.9180	0.9956	0.9997	0.9999	(94)
Ext temp.	846.4106	1059.3779	1309.4908	1590.6342	1695.5684	1372.9735	938.2783	971.9703	1212.8779	1038.7959	848.9564	786.0514	(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	3990.4378	3854.5473	3477.9230	2887.6647	2215.2555	1470.5141	950.2948	999.9928	1580.7582	2418.6871	3260.1439	3974.9096	(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	2339.1562	1878.3538	1613.3136	933.8619	386.6472	0.0000	0.0000	0.0000	0.0000	1026.6390	1736.0550	2372.5105	(98)
Space heating												12286.5373	(98)
Space heating per m2												44.5164	(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	2484.0478	1955.5270	2004.4650	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8135	0.8927	0.8386	0.0000	0.0000	0.0000	0.0000	(101)

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Calculation Type: New Build (As Designed)



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CALCULATION OF TARGET FABRIC ENERGY EFFICIENCY 09 Jan 2014

Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	2020.6724	1745.6633	1680.9688	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	2273.9598	2160.6122	1935.8057	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	182.3670	308.7220	189.5987	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												680.6876 (104)
Cooled fraction									FC = cooled area / (4) =			1.0000 (105)
Intermittency factor (Table 10b)	0.0000	0.0000	0.0000	0.0000	0.0000	0.2500	0.2500	0.2500	0.0000	0.0000	0.0000	0.0000 (106)
Space cooling kWh	0.0000	0.0000	0.0000	0.0000	0.0000	45.5917	77.1805	47.3997	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												170.1719 (107)
Space cooling per m2												0.6166 (108)
Energy for space heating												44.5164 (99)
Energy for space cooling												0.6166 (108)
Total												45.1330 (109)
Target Fabric Energy Efficiency (TFEE)												51.9 (109)

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Calculation Type: New Build (As Designed)



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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					6 * 10 = 60.0000 (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) =				60.0000 / (5) = 0.0846 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2846 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2846 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.9000	3.9000	3.6000	3.6000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9750	0.9750	0.9000	0.9000	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.3059	0.2917	0.2917	0.2775	0.2775	0.2561	0.2561	0.2490	0.2490	0.2704	0.2632	0.2775 (22b)
Effective ac	0.5468	0.5425	0.5425	0.5385	0.5385	0.5328	0.5328	0.5310	0.5310	0.5365	0.5346	0.5385 (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
Glazing (Uw = 0.80)			31.5600	0.7752	24.4651		(27)
Door			2.8100	1.0000	2.8100		(26)
Roof window (Uw = 0.80)			4.8600	0.7752	3.7674		(27a)
Heat Loss Floor 1			121.0000	0.1200	14.5200		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1700	33.2231		(29a)
External Roof 1	35.0000		35.0000	0.0700	2.4500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1200	9.1536		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3893		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.9106 (36)
Total fabric heat loss						(33) + (36) =	120.2999 (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	127.9885	126.9932	126.9932	126.0453	126.0453	124.7123	124.7123	124.2917	124.2917	125.5891	125.1448	126.0453 (38)
Heat transfer coeff	248.2883	247.2930	247.2930	246.3452	246.3452	245.0122	245.0122	244.5916	244.5916	245.8890	245.4447	246.3452 (39)
Average = Sum(39)m / 12 =												246.0376 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8996	0.8960	0.8960	0.8926	0.8926	0.8877	0.8877	0.8862	0.8862	0.8909	0.8893	0.8926 (40)
HLP (average)												0.8914 (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	3.1007 (42)
Average daily hot water use (litres/day)	107.8423 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy conte	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Energy content (annual)										Total = Sum(45)m =		1696.7799 (45)
Distribution loss (46)m = 0.15 x (45)m												
	26.3880	23.0791	23.8155	20.7630	19.9226	17.1917	15.9306	18.2806	18.4989	21.5587	23.5330	25.5553 (46)
Water storage loss:												

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Calculation Type: New Build (As Designed)



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CALCULATION OF HEAT DEMAND 09 Jan 2014

Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800		(56)
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800		(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624		(59)
Total heat required for water heating calculated for each month													
232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113		(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 =													
Output from w/h													
232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113		(64)
RHI water heating demand													
Heat gains from water heating, kWh/month													
103.8872	92.1596	98.1851	89.9542	89.5556	82.0378	80.7067	85.9159	84.9355	93.1824	96.0945	102.0416		(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	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
105.5955	93.7890	76.2744	57.7446	43.1648	36.4415	39.3763	51.1829	68.6975	87.2273	101.8071	108.5304		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
654.5176	661.3094	644.1942	607.7579	561.7636	518.5355	489.6564	482.8646	499.9798	536.4161	582.4104	625.6385		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051		(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		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292		(71)
Water heating gains (Table 5)													
139.6334	137.1423	131.9692	124.9364	120.3704	113.9414	108.4768	115.4784	117.9660	125.2452	133.4645	137.1527		(72)
Total internal gains													
1018.4662	1010.9604	971.1574	909.1586	844.0185	787.6381	756.2293	768.2455	805.3631	867.6083	936.4018	990.0413		(73)

6. Solar gains

[Jan]		Area	Solar flux	Specific data	FF	Access	Gains
		m2	Table 6a	g	Specific data	factor	W
			W/m2	or Table 6b	or Table 6c	Table 6d	
Northeast		19.5900	14.6176	0.6300	0.7000	0.7700	87.5153 (75)
Southeast		2.8800	45.1778	0.6300	0.7000	0.7700	39.7640 (77)
Southwest		8.2800	45.1778	0.6300	0.7000	0.7700	114.3214 (79)
Northwest		0.8100	14.6176	0.6300	0.7000	0.7700	3.6185 (81)
Northeast		2.4300	34.0000	0.6300	0.7000	1.0000	32.7919 (82)
Southwest		2.4300	34.0000	0.6300	0.7000	1.0000	32.7919 (82)

Solar gains	310.8029	497.9971	804.9590	1187.1696	1397.8005	1589.6498	1451.2467	1274.2424	979.8146	620.8738	381.4153	245.2962 (83)
Total gains	1329.2691	1508.9576	1776.1164	2096.3281	2241.8190	2377.2879	2207.4760	2042.4879	1785.1777	1488.4821	1317.8171	1235.3375 (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	77.1952	77.5059	77.5059	77.8041	77.8041	78.2274	78.2274	78.3619	77.9485	78.0896	77.8041		
alpha	6.1463	6.1671	6.1671	6.1869	6.1869	6.2152	6.2152	6.2241	6.2241	6.1966	6.2060		
util living area													
0.9991	0.9978	0.9907	0.9471	0.8061	0.5500	0.3988	0.4180	0.7559	0.9744	0.9974	0.9994		(86)
Tweekday	19.1772	19.3031	19.5558	19.8797	20.0653	20.1116	20.1137	20.1151	20.0985	19.8546	19.4740	19.1565	
Tweekend	20.5271	20.5817	20.6941	20.8419	20.9390	20.9690	20.9714	20.9714	20.9555	20.8268	20.6551	20.5158	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	14	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.4337	20.3530	20.5279	20.7532	20.9058	20.9524	20.9558	20.9558	20.9305	20.7327	20.4615	20.2527 (87)	
Th 2	20.1678	20.1709	20.1709	20.1738	20.1738	20.1779	20.1779	20.1792	20.1792	20.1752	20.1766	20.1738 (88)	
util rest of house													
0.9988	0.9971	0.9872	0.9278	0.7492	0.4695	0.3082	0.3207	0.6720	0.9610	0.9962	0.9992		(89)
Tweekday	19.1772	19.3031	19.5558	19.8797	20.0653	20.1116	20.1137	20.1151	20.0985	19.8546	19.4740	19.1565	
Tweekend	19.1772	19.3031	19.5558	19.8797	20.0653	20.1116	20.1137	20.1151	20.0985	19.8546	19.4740	19.1565	
MIT 2	19.1772	19.3031	19.5558	19.8797	20.0653	20.1116	20.1137	20.1151	20.0985	19.8546	19.4740	19.1565 (90)	
Living area fraction													
fLA = Living area / (4) =													
MIT	19.2938	19.4005	19.6459	19.9607	20.1433	20.1896	20.1918	20.1931	20.1756	19.9360	19.5656	19.2582 (92)	
Temperature adjustment													
adjusted MIT	19.2938	19.4005	19.6459	19.9607	20.1433	20.1896	20.1918	20.1931	20.1756	19.9360	19.5656	19.2582 (93)	

8. Space heating requirement

Utilisation	0.9983	0.9961	0.9843	0.9218	0.7468	0.4706	0.3097	0.3223	0.6716	0.9559	0.9950	0.9989 (94)
Useful gains	1327.0309	1503.0037	1748.1632	1932.4211	1674.2967	1118.8362	683.7043	658.3077	1198.9508	1422.7784	1311.1661	1233.9311 (95)
Ext temp.	5.3000	5.8000	7.4000	9.9000	12.9000	15.6000	17.4000	17.5000	15.1000	11.7000	8.2000	5.3000 (96)

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Calculation Type: New Build (As Designed)



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CALCULATION OF HEAT DEMAND 09 Jan 2014

Heat loss rate W	3474.4870	3363.3133	3028.3303	2478.4010	1784.3530	1124.5124	684.0292	658.6974	1241.4582	2025.1455	2789.6272	3438.5379 (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												
Space heating	1597.7074	1250.1281	952.4443	393.1055	81.8819	0.0000	0.0000	0.0000	0.0000	448.1612	1064.4920	1640.2275 (98)
RHI space heating demand												7428.1479 (98)
												7428 (98)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					6 * 10 = 60.0000 (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) =				60.0000 / (5) = 0.0846 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2846 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2846 (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	0.3629	0.3557	0.3486	0.3130	0.3059	0.2704	0.2704	0.2632	0.2846	0.3059	0.3202	0.3344 (22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5513	0.5559 (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
Glazing (Uw = 0.80)			31.5600	0.7752	24.4651		(27)
Door			2.8100	1.0000	2.8100		(26)
Roof window (Uw = 0.80)			4.8600	0.7752	3.7674		(27a)
Heat Loss Floor 1			121.0000	0.1200	14.5200		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1700	33.2231		(29a)
External Roof 1	35.0000		35.0000	0.0700	2.4500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1200	9.1536		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3893		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.9106 (36)
Total fabric heat loss						(33) + (36) =	120.2999 (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	132.4435	131.8452	131.2587	128.5039	127.9885	125.5891	125.5891	125.1448	126.5133	127.9885	129.0311	130.1212 (38)
Heat transfer coeff	252.7434	252.1450	251.5585	248.8037	248.2883	245.8890	245.8890	245.4447	246.8132	248.2883	249.3310	250.4211 (39)
Average = Sum(39)m / 12 =												248.8013 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9157	0.9136	0.9114	0.9015	0.8996	0.8909	0.8909	0.8893	0.8943	0.8996	0.9034	0.9073 (40)
HLP (average)												0.9015 (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												3.1007 (42)
Average daily hot water use (litres/day)												107.8423 (43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Daily hot water use	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy conte	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Energy content (annual)												Total = Sum(45)m = 1696.7799 (45)
Distribution loss (46)m = 0.15 x (45)m												
	26.3880	23.0791	23.8155	20.7630	19.9226	17.1917	15.9306	18.2806	18.4989	21.5587	23.5330	25.5553 (46)
Water storage loss:												

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Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

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Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800		(56)
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800		(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624	22.5120	23.2624		(59)
Total heat required for water heating calculated for each month													
232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113		(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 =													
Output from w/h													
232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113		(64)
Heat gains from water heating, kWh/month													
103.8872	92.1596	98.1851	89.9542	89.5556	82.0378	80.7067	85.9159	84.9355	93.1824	96.0945	102.0416		(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	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
105.5955	93.7890	76.2744	57.7446	43.1648	36.4415	39.3763	51.1829	68.6975	87.2273	101.8071	108.5304		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
654.5176	661.3094	644.1942	607.7579	561.7636	518.5355	489.6564	482.8646	499.9798	536.4161	582.4104	625.6385		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051		(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		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292		(71)
Water heating gains (Table 5)													
139.6334	137.1423	131.9692	124.9364	120.3704	113.9414	108.4768	115.4784	117.9660	125.2452	133.4645	137.1527		(72)
Total internal gains													
1018.4662	1010.9604	971.1574	909.1586	844.0185	787.6381	756.2293	768.2455	805.3631	867.6083	936.4018	990.0413		(73)

6. Solar gains

[Jan]													
Area	Solar flux	g	FF	Access	Gains								
m2	Table 6a	or Table 6b	Specific data	factor	W								
	W/m2		or Table 6c	Table 6d									
Northeast	19.5900	11.2829	0.6300	0.7700	67.5505								(75)
Southeast	2.8800	36.7938	0.6300	0.7700	32.3847								(77)
Southwest	8.2800	36.7938	0.6300	0.7700	93.1059								(79)
Northwest	0.8100	11.2829	0.6300	0.7700	2.7931								(81)
Northeast	2.4300	26.0000	0.6300	1.0000	25.0761								(82)
Southwest	2.4300	26.0000	0.6300	1.0000	25.0761								(82)
Solar gains	245.9864	461.1056	735.6254	1075.3975	1345.7553	1395.8986	1321.0432	1111.6741	852.8602	538.5416	302.4740	205.3475	(83)
Total gains	1264.4526	1472.0660	1706.7828	1984.5561	2189.7738	2183.5366	2077.2725	1879.9196	1658.2233	1406.1498	1238.8757	1195.3887	(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	75.8345	76.0145	76.1917	77.0353	77.1952	77.9485	78.0896	77.6566	77.1952	76.8724	76.5378		
alpha	6.0556	6.0676	6.0794	6.1357	6.1463	6.1966	6.2060	6.1771	6.1463	6.1248	6.1025		
util living area	0.9995	0.9986	0.9947	0.9721	0.8818	0.6915	0.5164	0.5902	0.8719	0.9890	0.9988	0.9997	(86)
Tweekday	19.0172	19.1617	19.4118	19.7511	20.0017	20.0993	20.1100	20.1101	20.0492	19.7142	19.3088	19.0001	
Tweekend	20.4614	20.5246	20.6348	20.7845	20.9060	20.9606	20.9700	20.9683	20.9270	20.7654	20.5864	20.4513	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	14	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.3550	20.2646	20.4363	20.6635	20.8550	20.9394	20.9537	20.9510	20.8860	20.6379	20.3541	20.1531	(87)
Th 2	20.1541	20.1560	20.1578	20.1663	20.1678	20.1752	20.1752	20.1766	20.1724	20.1678	20.1646	20.1613	(88)
util rest of house	0.9994	0.9982	0.9928	0.9616	0.8420	0.6143	0.4220	0.4900	0.8136	0.9834	0.9983	0.9996	(89)
Tweekday	19.0172	19.1617	19.4118	19.7511	20.0017	20.0993	20.1100	20.1101	20.0492	19.7142	19.3088	19.0001	
Tweekend	19.0172	19.1617	19.4118	19.7511	20.0017	20.0993	20.1100	20.1101	20.0492	19.7142	19.3088	19.0001	
MIT 2	19.0172	19.1617	19.4118	19.7511	20.0017	20.0993	20.1100	20.1101	20.0492	19.7142	19.3088	19.0001	(90)
Living area fraction									fLA = Living area / (4) =				
MIT	19.1413	19.2640	19.5069	19.8357	20.0808	20.1773	20.1882	20.1881	20.1269	19.7999	19.4057	19.1071	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.1413	19.2640	19.5069	19.8357	20.0808	20.1773	20.1882	20.1881	20.1269	19.7999	19.4057	19.1071	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Useful gains	1263.2944	1468.3532	1691.0052	1897.9674	1833.2827	1341.7742	879.7819	923.7809	1342.9483	1377.8672	1236.0128	1194.6089	(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													

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Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Month fracti	3751.0380	3621.8139	3271.9853	2720.8393	2080.8622	1371.3871	882.3057	929.7676	1487.5079	2284.2160	3068.2027	3733.0457 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating	1850.8812	1447.1256	1176.2492	592.4678	184.1992	0.0000	0.0000	0.0000	0.0000	674.3236	1319.1767	1888.5969 (98)
Space heating												9133.0201 (98)
Space heating per m2											(98) / (4) =	33.0907 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												249.0851 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												3666.6268 (211)
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1850.8812	1447.1256	1176.2492	592.4678	184.1992	0.0000	0.0000	0.0000	0.0000	674.3236	1319.1767	1888.5969 (98)
Space heating efficiency (main heating system 1)	249.0851	249.0851	249.0851	249.0851	249.0851	0.0000	0.0000	0.0000	0.0000	249.0851	249.0851	249.0851 (210)
Space heating fuel (main heating system)	743.0719	580.9764	472.2279	237.8576	73.9503	0.0000	0.0000	0.0000	0.0000	270.7202	529.6089	758.2136 (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	232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113 (64)
Efficiency of water heater	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600 (216)
(217)m	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600 (217)
Fuel for water heating, kWh/month	145.7235	128.4678	134.9823	121.0897	118.7270	106.1775	102.0584	111.8709	111.6361	125.5588	132.6561	142.2468 (219)
Water heating fuel used												1481.1950 (219)
Annual totals kWh/year												
Space heating fuel - main system												3666.6268 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												745.9401 (232)
Electricity for lighting (calculated in Appendix L)												5893.7619 (238)
Total delivered energy for all uses												

10a. Fuel costs - using Table 12 prices

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	3666.6268	13.1900	483.6281 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1481.1950	13.1900	195.3696 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	745.9401	13.1900	98.3895 (250)
Additional standing charges			0.0000 (251)
Total energy cost			777.3872 (255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	1.0171 (257)
SAP value		85.8109
SAP rating (Section 12)		86 (258)
SAP band		B

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	3666.6268	0.5190	1902.9793 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1481.1950	0.5190	768.7402 (264)
Space and water heating			2671.7195 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	745.9401	0.5190	387.1429 (268)
Total kg/year			3058.8624 (272)
CO2 emissions per m2			11.0800 (273)
EI value			87.2309
EI rating			87 (274)
EI band			B

Calculation of stars for heating and DHW

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS 09 Jan 2014

Main heating energy efficiency	$13.19 \times (1 + 0.29 \times 0.25) / 2.4909 = 5.679$, stars = 3
Main heating environmental impact	$0.519 \times (1 + 0.29 \times 0.25) / 2.4909 = 0.2235$, stars = 4
Water heating energy efficiency	$13.19 / 1.5966 = 8.261$, stars = 2
Water heating environmental impact	$0.519 / 1.5966 = 0.3251$, stars = 4

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Calculation Type: New Build (As Designed)



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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					6 * 10 = 60.0000 (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) =				60.0000 / (5) = 0.0846 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2846 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2846 (21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind speed	4.3000	4.1000	4.1000	3.9000	3.9000	3.6000	3.6000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Wind factor	1.0750	1.0250	1.0250	0.9750	0.9750	0.9000	0.9000	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Adj infilt rate	0.3059	0.2917	0.2917	0.2775	0.2775	0.2561	0.2561	0.2490	0.2490	0.2704	0.2632	0.2775 (22b)
Effective ac	0.5468	0.5425	0.5425	0.5385	0.5385	0.5328	0.5328	0.5310	0.5310	0.5365	0.5346	0.5385 (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
Glazing (Uw = 0.80)			31.5600	0.7752	24.4651		(27)
Door			2.8100	1.0000	2.8100		(26)
Roof window (Uw = 0.80)			4.8600	0.7752	3.7674		(27a)
Heat Loss Floor 1			121.0000	0.1200	14.5200		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1700	33.2231		(29a)
External Roof 1	35.0000		35.0000	0.0700	2.4500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1200	9.1536		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3893		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.9106 (36)
Total fabric heat loss						(33) + (36) =	120.2999 (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	127.9885	126.9932	126.9932	126.0453	126.0453	124.7123	124.7123	124.2917	124.2917	125.5891	125.1448	126.0453 (38)
Heat transfer coeff	248.2883	247.2930	247.2930	246.3452	246.3452	245.0122	245.0122	244.5916	244.5916	245.8890	245.4447	246.3452 (39)
Average = Sum(39)m / 12 =												246.0376 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.8996	0.8960	0.8960	0.8926	0.8926	0.8877	0.8877	0.8862	0.8862	0.8909	0.8893	0.8926 (40)
HLP (average)												0.8914 (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												3.1007 (42)
Average daily hot water use (litres/day)												107.8423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy conte	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Energy content (annual)										Total = Sum(45)m =		1696.7799 (45)
Distribution loss (46)m = 0.15 x (45)m												
	26.3880	23.0791	23.8155	20.7630	19.9226	17.1917	15.9306	18.2806	18.4989	21.5587	23.5330	25.5553 (46)
Water storage loss:												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800		(56)
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800		(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120		(59)
Total heat required for water heating calculated for each month													
232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113		(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 =													(63)
Output from w/h													
232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113		(64)
Heat gains from water heating, kWh/month													
103.8872	92.1596	98.1851	89.9542	89.5556	82.0378	80.7067	85.9159	84.9355	93.1824	96.0945	102.0416		(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	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438		(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
105.5955	93.7890	76.2744	57.7446	43.1648	36.4415	39.3763	51.1829	68.6975	87.2273	101.8071	108.5304		(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
654.5176	661.3094	644.1942	607.7579	561.7636	518.5355	489.6564	482.8646	499.9798	536.4161	582.4104	625.6385		(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051		(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		(70)
Losses e.g. evaporation (negative values) (Table 5)													
-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292		(71)
Water heating gains (Table 5)													
139.6334	137.1423	131.9692	124.9364	120.3704	113.9414	108.4768	115.4784	117.9660	125.2452	133.4645	137.1527		(72)
Total internal gains													
1018.4662	1010.9604	971.1574	909.1586	844.0185	787.6381	756.2293	768.2455	805.3631	867.6083	936.4018	990.0413		(73)

6. Solar gains

[Jan]													
Area	Solar flux	Specific data	Specific data	FF	Access	Gains							
m2	Table 6a	g	or Table 6b	or Table 6c	factor	W							
	W/m2				Table 6d								
Northeast	19.5900	14.6176	0.6300	0.7000	0.7700	87.5153							(75)
Southeast	2.8800	45.1778	0.6300	0.7000	0.7700	39.7640							(77)
Southwest	8.2800	45.1778	0.6300	0.7000	0.7700	114.3214							(79)
Northwest	0.8100	14.6176	0.6300	0.7000	0.7700	3.6185							(81)
Northeast	2.4300	34.0000	0.6300	0.7000	1.0000	32.7919							(82)
Southwest	2.4300	34.0000	0.6300	0.7000	1.0000	32.7919							(82)
Solar gains	310.8029	497.9971	804.9590	1187.1696	1397.8005	1589.6498	1451.2467	1274.2424	979.8146	620.8738	381.4153	245.2962	(83)
Total gains	1329.2691	1508.9576	1776.1164	2096.3281	2241.8190	2377.2879	2207.4760	2042.4879	1785.1777	1488.4821	1317.8171	1235.3375	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	77.1952	77.5059	77.5059	77.8041	77.8041	78.2274	78.2274	78.3619	78.3619	77.9485	78.0896	77.8041	
alpha	6.1463	6.1671	6.1671	6.1869	6.1869	6.2152	6.2152	6.2241	6.2241	6.1966	6.2060	6.1869	
util living area	0.9991	0.9978	0.9907	0.9471	0.8061	0.5500	0.3988	0.4180	0.7559	0.9744	0.9974	0.9994	(86)
Tweekday	19.1772	19.3031	19.5558	19.8797	20.0653	20.1116	20.1137	20.1151	20.0985	19.8546	19.4740	19.1565	
Tweekend	20.5271	20.5817	20.6941	20.8419	20.9390	20.9690	20.9714	20.9714	20.9555	20.8268	20.6551	20.5158	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	14	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.4337	20.3530	20.5279	20.7532	20.9058	20.9524	20.9558	20.9558	20.9305	20.7327	20.4615	20.2527	(87)
Th 2	20.1678	20.1709	20.1709	20.1738	20.1738	20.1779	20.1779	20.1792	20.1792	20.1752	20.1766	20.1738	(88)
util rest of house	0.9988	0.9971	0.9872	0.9278	0.7492	0.4695	0.3082	0.3207	0.6720	0.9610	0.9962	0.9992	(89)
Tweekday	19.1772	19.3031	19.5558	19.8797	20.0653	20.1116	20.1137	20.1151	20.0985	19.8546	19.4740	19.1565	
Tweekend	19.1772	19.3031	19.5558	19.8797	20.0653	20.1116	20.1137	20.1151	20.0985	19.8546	19.4740	19.1565	
MIT 2	19.1772	19.3031	19.5558	19.8797	20.0653	20.1116	20.1137	20.1151	20.0985	19.8546	19.4740	19.1565	(90)
Living area fraction													
MIT	19.2938	19.4005	19.6459	19.9607	20.1433	20.1896	20.1918	20.1931	20.1756	19.9360	19.5656	19.2582	(91)
Temperature adjustment													
adjusted MIT	19.2938	19.4005	19.6459	19.9607	20.1433	20.1896	20.1918	20.1931	20.1756	19.9360	19.5656	19.2582	(93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
0.9983	0.9961	0.9843	0.9218	0.7468	0.4706	0.3097	0.3223	0.6716	0.9559	0.9950	0.9989	0.9989	(94)
Useful gains	1327.0309	1503.0037	1748.1632	1932.4211	1674.2967	1118.8362	683.7043	658.3077	1198.9508	1422.7784	1311.1661	1233.9311	(95)
Ext temp.	5.3000	5.8000	7.4000	9.9000	12.9000	15.6000	17.4000	17.5000	15.1000	11.7000	8.2000	5.3000	(96)
Heat loss rate W													

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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Month fraction	3474.4870	3363.3133	3028.3303	2478.4010	1784.3530	1124.5124	684.0292	658.6974	1241.4582	2025.1455	2789.6272	3438.5379 (97)
Space heating kWh	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating requirement	1597.7074	1250.1281	952.4443	393.1055	81.8819	0.0000	0.0000	0.0000	0.0000	448.1612	1064.4920	1640.2275 (98)
Space heating requirement												7428.1479 (98)
Space heating requirement per m2											(98) / (4) =	26.9136 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												248.4621 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												2989.6509 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Space heating requirement	1597.7074	1250.1281	952.4443	393.1055	81.8819	0.0000	0.0000	0.0000	0.0000	448.1612	1064.4920	1640.2275 (98)
Space heating efficiency (main heating system 1)	248.4621	248.4621	248.4621	248.4621	248.4621	0.0000	0.0000	0.0000	0.0000	248.4621	248.4621	248.4621 (210)
Space heating fuel (main heating system)	643.0388	503.1465	383.3359	158.2155	32.9555	0.0000	0.0000	0.0000	0.0000	180.3741	428.4324	660.1521 (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	232.6622	205.1118	215.5127	193.3318	189.5595	169.5231	162.9464	178.6130	178.2382	200.4672	211.7988	227.1113 (64)
Efficiency of water heater	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600 (216)
Fuel for water heating, kWh/month	145.7235	128.4678	134.9823	121.0897	118.7270	106.1775	102.0584	111.8709	111.6361	125.5588	132.6561	142.2468 (219)
Water heating fuel used												1481.1950 (219)
Annual totals kWh/year												
Space heating fuel - main system												2989.6509 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												0.0000 (231)
Total electricity for the above, kWh/year												745.9401 (232)
Electricity for lighting (calculated in Appendix L)												5216.7860 (238)
Total delivered energy for all uses												

10a. Fuel costs - using BEDF prices (531)

	Fuel	Fuel price	Fuel cost
	kWh/year	p/kWh	£/year
Space heating - main system 1	2989.6509	36.7200	1097.7998 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	1481.1950	36.7200	543.8948 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Energy for lighting	745.9401	36.7200	273.9092 (250)
Additional standing charges			0.0000 (251)
Total energy cost			1915.6038 (255)

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

	Energy	Emission factor	Emissions
	kWh/year	kg CO2/kWh	kg CO2/year
Space heating - main system 1	2989.6509	0.5190	1551.6288 (261)
Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	1481.1950	0.5190	768.7402 (264)
Space and water heating			2320.3690 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	745.9401	0.5190	387.1429 (268)
Total kg/year			2707.5119 (272)

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

	Energy	Primary energy factor	Primary energy
	kWh/year	kg CO2/kWh	kWh/year
Space heating - main system 1	2989.6509	3.0700	9178.2282 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	1481.1950	3.0700	4547.2686 (264)
Space and water heating			13725.4968 (265)
Pumps and fans	0.0000	0.0000	0.0000 (267)
Energy for lighting	745.9401	3.0700	2290.0363 (268)
Primary energy kWh/year			16015.5331 (272)
Primary energy kWh/m2/year			58.0273 (273)

SAP 2012 EPC IMPROVEMENTS

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Current energy efficiency rating: B 86
Current environmental impact rating: B 87

(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	-£ 211	-298 kg (11.0%)
U Solar photovoltaic panels	+ 4.2	-£ 704	-994 kg (41.3%)

Recommended measures	Typical annual savings		Energy efficiency	Environmental impact
Solar water heating	£211	1.08 kg/m ²	B 87	B 88
Solar photovoltaic panels	£704	3.60 kg/m ²	B 91	A 92
Total Savings	£914	4.68 kg/m ²		

Potential energy efficiency rating: B 91
Potential environmental impact rating: A 92

Fuel prices for cost data on this page from database revision number 531 TEST (31 Oct 2023)
Recommendation texts revision number 4.9c (22 Feb 2014)

Typical heating and lighting costs of this home (per year, Southern England):

	Current	Potential	Saving
Electricity	£1916	£1705	£211
Space heating	£1098	£1099	-£1
Water heating	£544	£332	£212
Lighting	£274	£274	£0
Generated (PV)	-£0	-£704	£704
Total cost of fuels	£1916	£1001	£915
Total cost of uses	£1916	£1001	£915
Delivered energy	19 kWh/m ²	10 kWh/m ²	9 kWh/m ²
Carbon dioxide emissions	2.7 tonnes	1.4 tonnes	1.3 tonnes
CO2 emissions per m ²	10 kg/m ²	5 kg/m ²	5 kg/m ²
Primary energy	58 kWh/m ²	30 kWh/m ²	28 kWh/m ²

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					6 * 10 = 60.0000 (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) =				60.0000 / (5) = 0.0846 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2846 (18)
Number of sides sheltered					0 (19)
Shelter factor	(20) = 1 - [0.075 x (19)] =				1.0000 (20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =				0.2846 (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	0.3629	0.3557	0.3486	0.3130	0.3059	0.2704	0.2704	0.2632	0.2846	0.3059	0.3202	0.3344 (22b)
Effective ac	0.5658	0.5633	0.5608	0.5490	0.5468	0.5365	0.5365	0.5346	0.5405	0.5468	0.5513	0.5559 (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
Glazing (Uw = 0.80)			31.5600	0.7752	24.4651		(27)
Door			2.8100	1.0000	2.8100		(26)
Roof window (Uw = 0.80)			4.8600	0.7752	3.7674		(27a)
Heat Loss Floor 1			121.0000	0.1200	14.5200		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1700	33.2231		(29a)
External Roof 1	35.0000		35.0000	0.0700	2.4500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1200	9.1536		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3893		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.9106 (36)
Total fabric heat loss						(33) + (36) =	120.2999 (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	132.4435	131.8452	131.2587	128.5039	127.9885	125.5891	125.5891	125.1448	126.5133	127.9885	129.0311	130.1212 (38)
Heat transfer coeff	252.7434	252.1450	251.5585	248.8037	248.2883	245.8890	245.8890	245.4447	246.8132	248.2883	249.3310	250.4211 (39)
Average = Sum(39)m / 12 =												248.8013 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP	0.9157	0.9136	0.9114	0.9015	0.8996	0.8909	0.8909	0.8893	0.8943	0.8996	0.9034	0.9073 (40)
HLP (average)												0.9015 (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												3.1007 (42)
Average daily hot water use (litres/day)												107.8423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy conte	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Energy content (annual)										Total = Sum(45)m =		1696.7799 (45)
Distribution loss (46)m = 0.15 x (45)m												
	26.3880	23.0791	23.8155	20.7630	19.9226	17.1917	15.9306	18.2806	18.4989	21.5587	23.5330	25.5553 (46)
Water storage loss:												

Regs Region: England

Elmhurst Energy Systems

SAP2012 Calculator (Design

System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	32.4000	(56)
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	32.4000	(57)
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
232.6622	205.1118	214.1170	186.5782	176.7652	156.9163	149.9195	166.5166	172.8353	199.0714	211.7988	227.1113	227.1113	(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													1.0688 (H8)
Utilisation factor													0.6076 (H9)
Collector performance factor													0.8793 (H10)
Dedicated solar storage volume													75.0000 (H11)
Effective solar volume													75.0000 (H13)
Daily hot water demand													107.8423 (H14)
Volume ratio Veff/V													0.6955 (H15)
Solar storage volume factor													0.9274 (H16)
Solar input													-898.6177 (H17)
Solar input	-26.0581	-43.4835	-74.0574	-99.2515	-122.6169	-120.5519	-118.9588	-103.9349	-81.4019	-55.5879	-30.9087	-21.8062	(63)
Solar input (sum of months) = Sum(63)m =													-898.6177 (63)
Output from w/h													
206.6041	161.6282	140.0596	87.3267	54.1483	36.3644	30.9607		62.5817	91.4334	143.4835	180.8901	205.3051	(64)
Total per year (kWh/year) = Sum(64)m =													1400.7858 (64)
Heat gains from water heating, kWh/month													
103.8872	92.1596	97.0685	84.5513	79.3202	71.9524	70.2852	76.2387	80.6132	92.0658	96.0945	102.0416	102.0416	(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	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
105.5955	93.7890	76.2744	57.7446	43.1648	36.4415	39.3763	51.1829	68.6975	87.2273	101.8071	108.5304	108.5304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
654.5176	661.3094	644.1942	607.7579	561.7636	518.5355	489.6564	482.8646	499.9798	536.4161	582.4104	625.6385	625.6385	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	(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)													
-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	(71)
Water heating gains (Table 5)													
139.6334	137.1423	130.4684	117.4324	106.6131	99.9339	94.4693	102.4714	111.9628	123.7444	133.4645	137.1527	137.1527	(72)
Total internal gains													
1018.4662	1010.9604	969.6566	901.6546	830.2612	773.6306	742.2218	755.2386	799.3599	866.1075	936.4018	990.0413	990.0413	(73)

6. Solar gains

[Jan]													
	Area	Solar flux	g	FF	Access	Gains							
	m2	Table 6a	Specific data	Specific data	factor	W							
		W/m2	or Table 6b	or Table 6c	Table 6d								
Northeast	19.5900	11.2829	0.6300	0.7000	0.7700	67.5505	(75)						
Southeast	2.8800	36.7938	0.6300	0.7000	0.7700	32.3847	(77)						
Southwest	8.2800	36.7938	0.6300	0.7000	0.7700	93.1059	(79)						
Northwest	0.8100	11.2829	0.6300	0.7000	0.7700	2.7931	(81)						
Northeast	2.4300	26.0000	0.6300	0.7000	1.0000	25.0761	(82)						
Southwest	2.4300	26.0000	0.6300	0.7000	1.0000	25.0761	(82)						
Solar gains	245.9864	461.1056	735.6254	1075.3975	1345.7553	1395.8986	1321.0432	1111.6741	852.8602	538.5416	302.4740	205.3475	(83)
Total gains	1264.4526	1472.0660	1705.2820	1977.0521	2176.0165	2169.5292	2063.2650	1866.9127	1652.2201	1404.6490	1238.8757	1195.3887	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Thl (C)													21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec		
tau	75.8345	76.0145	76.1917	77.0353	77.1952	77.9485	77.9485	78.0896	77.6566	77.1952	76.8724	76.5378	
alpha	6.0556	6.0676	6.0794	6.1357	6.1463	6.1966	6.1966	6.2060	6.1771	6.1463	6.1248	6.1025	
util living area													
0.9995	0.9986	0.9947	0.9726	0.8843	0.6951	0.5198	0.5939	0.8734	0.9891	0.9988	0.9997	0.9997	(86)
Tweekday	19.0172	19.1617	19.4113	19.7487	19.9996	20.0990	20.1099	20.1100	20.0485	19.7136	19.3088	19.0001	
Tweekend	20.4614	20.5246	20.6345	20.7834	20.9048	20.9603	20.9700	20.9682	20.9265	20.7652	20.5864	20.4513	
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0	
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
16 / 9	14	0	0	0	0	0	0	0	0	0	0	0	
MIT	20.3550	20.2646	20.4359	20.6618	20.8531	20.9390	20.9537	20.9509	20.8853	20.6376	20.3541	20.1531	(87)
Th 2	20.1541	20.1560	20.1578	20.1663	20.1678	20.1752	20.1752	20.1766	20.1724	20.1678	20.1646	20.1613	(88)
util rest of house													
0.9994	0.9982	0.9928	0.9623	0.8449	0.6178	0.4248	0.4933	0.8154	0.9834	0.9983	0.9996	0.9996	(89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

Tweekday	19.0172	19.1617	19.4113	19.7487	19.9996	20.0990	20.1099	20.1100	20.0485	19.7136	19.3088	19.0001
Tweekend	19.0172	19.1617	19.4113	19.7487	19.9996	20.0990	20.1099	20.1100	20.0485	19.7136	19.3088	19.0001
MIT 2	19.0172	19.1617	19.4113	19.7487	19.9996	20.0990	20.1099	20.1100	20.0485	19.7136	19.3088	19.0001 (90)
Living area fraction									fLA = Living area / (4) =			0.0928 (91)
MIT	19.1413	19.2640	19.5063	19.8334	20.0788	20.1769	20.1882	20.1880	20.1261	19.7993	19.4057	19.1071 (92)
Temperature adjustment												0.0000
adjusted MIT	19.1413	19.2640	19.5063	19.8334	20.0788	20.1769	20.1882	20.1880	20.1261	19.7993	19.4057	19.1071 (93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9991	0.9975	0.9908	0.9570	0.8400	0.6180	0.4264	0.4947	0.8116	0.9800	0.9977	0.9993	(94)
Useful gains	1263.2944	1468.3532	1689.5850	1892.1040	1827.8766	1340.7729	879.6768	923.5356	1340.9810	1376.5328	1236.0128	1194.6089	(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													
	3751.0380	3621.8139	3271.8483	2720.2723	2080.3509	1371.2956	882.2956	929.7444	1487.3228	2284.0879	3068.2027	3733.0457	(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													
	1850.8812	1447.1256	1177.2039	596.2812	187.8409	0.0000	0.0000	0.0000	0.0000	675.2210	1319.1767	1888.5969	(98)
Space heating												9142.3275	(98)
Space heating per m2												33.1244	(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 %)													249.0851 (206)
Efficiency of secondary/supplementary heating system, %													100.0000 (208)
Space heating requirement													3670.3634 (211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1850.8812	1447.1256	1177.2039	596.2812	187.8409	0.0000	0.0000	0.0000	0.0000	675.2210	1319.1767	1888.5969	(98)
Space heating efficiency (main heating system 1)	249.0851	249.0851	249.0851	249.0851	249.0851	0.0000	0.0000	0.0000	0.0000	249.0851	249.0851	249.0851	(210)
Space heating fuel (main heating system)	743.0719	580.9764	472.6112	239.3886	75.4123	0.0000	0.0000	0.0000	0.0000	271.0805	529.6089	758.2136	(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	206.6041	161.6282	140.0596	87.3267	54.1483	36.3644	30.9607	62.5817	91.4334	143.4835	180.8901	205.3051	(64)
Efficiency of water heater (217)m	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	(216)
Fuel for water heating, kWh/month	129.4025	101.2328	87.7236	54.6954	33.9148	22.7762	19.3916	39.1969	57.2676	89.8682	113.2971	128.5889	(219)
Water heating fuel used												877.3555	(219)
Annual totals kWh/year													
Space heating fuel - main system												3670.3634	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
pump for solar water heating												50.0000	(230g)
Total electricity for the above, kWh/year												50.0000	(231)
Electricity for lighting (calculated in Appendix L)												745.9401	(232)
Energy saving/generation technologies (Appendices M ,N and Q)													
PV Unit 0 (0.80 * 2.50 * 1080 * 0.80) =										-1727.2394		-1727.2394	(233)
Total delivered energy for all uses												3616.4197	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3670.3634	13.1900	484.1209	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	877.3555	13.1900	115.7232	(247)
Pumps and fans for heating	0.0000	0.0000	0.0000	(249)
Pump for solar water heating	50.0000	13.1900	6.5950	(249)
Energy for lighting	745.9401	13.1900	98.3895	(250)
Additional standing charges			0.0000	(251)
Energy saving/generation technologies				
PV Unit	-1727.2394	13.1900	-227.8229	(252)
Total energy cost			477.0058	(255)

11a. SAP rating - Individual heating systems

Energy cost deflator (Table 12):		0.4200 (256)
Energy cost factor (ECF)	[(255) x (256)] / [(4) + 45.0] =	0.6241 (257)
SAP value		91.2935

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
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CALCULATION OF ENERGY RATINGS FOR IMPROVED DWELLING 09 Jan 2014

SAP rating (Section 12)
SAP band

91 (258)
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	3670.3634	0.5190	1904.9186	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	877.3555	0.5190	455.3475	(264)
Space and water heating			2360.2661	(265)
Pumps and fans	50.0000	0.5190	25.9500	(267)
Energy for lighting	745.9401	0.5190	387.1429	(268)
Energy saving/generation technologies				
PV Unit	-1727.2394	0.5190	-896.4372	(269)
Total kg/year			1876.9218	(272)
CO2 emissions per m2			6.8000	(273)
EI value			92.1649	
EI rating			92	(274)
EI band			A	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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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	121.0000 (1b)	x 2.6000 (2b)	= 314.6000 (1b) - (3b)
First floor	121.0000 (1c)	x 2.7000 (2c)	= 326.7000 (1c) - (3c)
Second floor	34.0000 (1d)	x 2.0000 (2d)	= 68.0000 (1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	276.0000		(4)
Dwelling volume		(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	= 709.3000 (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					6 * 10 = 60.0000 (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) =					Air changes per hour 60.0000 / (5) = 0.0846 (8)
Pressure test					Yes
Measured/design AP50					4.0000
Infiltration rate					0.2846 (18)
Number of sides sheltered					0 (19)
Shelter factor			(20) = 1 - [0.075 x (19)] =		1.0000 (20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =		0.2846 (21)

Wind speed	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Wind factor	4.3000	4.1000	4.1000	3.9000	3.9000	3.6000	3.6000	3.5000	3.5000	3.8000	3.7000	3.9000 (22)
Adj infilt rate	1.0750	1.0250	1.0250	0.9750	0.9750	0.9000	0.9000	0.8750	0.8750	0.9500	0.9250	0.9750 (22a)
Effective ac	0.3059	0.2917	0.2917	0.2775	0.2775	0.2561	0.2561	0.2490	0.2490	0.2704	0.2632	0.2775 (22b)
	0.5468	0.5425	0.5425	0.5385	0.5385	0.5328	0.5328	0.5310	0.5310	0.5365	0.5346	0.5385 (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
Glazing (Uw = 0.80)			31.5600	0.7752	24.4651		(27)
Door			2.8100	1.0000	2.8100		(26)
Roof window (Uw = 0.80)			4.8600	0.7752	3.7674		(27a)
Heat Loss Floor 1			121.0000	0.1200	14.5200		(28a)
External Wall 1	229.8000	34.3700	195.4300	0.1700	33.2231		(29a)
External Roof 1	35.0000		35.0000	0.0700	2.4500		(30)
External Roof 2	81.1400	4.8600	76.2800	0.1200	9.1536		(30)
Total net area of external elements Aum(A, m ²)			466.9400				(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		90.3893		(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m ² K							250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							29.9106 (36)
Total fabric heat loss						(33) + (36) =	120.2999 (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	127.9885	126.9932	126.9932	126.0453	126.0453	124.7123	124.7123	124.2917	124.2917	125.5891	125.1448	126.0453 (38)
Average = Sum(39)m / 12 =	248.2883	247.2930	247.2930	246.3452	246.3452	245.0122	245.0122	244.5916	244.5916	245.8890	245.4447	246.3452 (39)
												246.0376 (39)
HLP	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HLP (average)	0.8996	0.8960	0.8960	0.8926	0.8926	0.8877	0.8877	0.8862	0.8862	0.8909	0.8893	0.8926 (40)
Days in month												0.8914 (40)
	31	28	31	30	31	30	31	31	30	31	30	31 (41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.1007 (42)
Average daily hot water use (litres/day)												107.8423 (43)
Daily hot water use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Energy conte	118.6266	114.3129	109.9992	105.6855	101.3718	97.0581	97.0581	101.3718	105.6855	109.9992	114.3129	118.6266 (44)
Energy content (annual)	175.9198	153.8606	158.7703	138.4198	132.8171	114.6111	106.2040	121.8706	123.3262	143.7248	156.8868	170.3689 (45)
Distribution loss (46)m = 0.15 x (45)m										Total = Sum(45)m =		1696.7799 (45)
Water storage loss:	26.3880	23.0791	23.8155	20.7630	19.9226	17.1917	15.9306	18.2806	18.4989	21.5587	23.5330	25.5553 (46)

Regs Region: England

Elmhurst Energy Systems
SAP2012 Calculator (Design
System) version 4.14r19

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



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

Store volume													300.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):													2.0000 (48)
Temperature factor from Table 2b													0.5400 (49)
Enter (49) or (54) in (55)													1.0800 (55)
Total storage loss													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(56)	
If cylinder contains dedicated solar storage													
33.4800	30.2400	33.4800	32.4000	33.4800	32.4000	33.4800	33.4800	32.4000	33.4800	32.4000	33.4800	(57)	
Primary loss	23.2624	21.0112	21.8667	15.7584	10.4681	9.9053	10.2355	11.1660	17.1091	21.8667	22.5120	(59)	
Total heat required for water heating calculated for each month													
232.6622	205.1118	214.1170	186.5782	176.7652	156.9163	149.9195	166.5166	172.8353	199.0714	211.7988	227.1113	(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												1197.5950 (H5)	
Overshading factor												0.8000 (H6)	
Solar energy available												2011.9596 (H7)	
Adjustment factor for showers												1.0000 (H7a)	
Solar-to-load ratio												1.1858 (H8)	
Utilisation factor												0.5697 (H9)	
Collector performance factor												0.8793 (H10)	
Dedicated solar storage volume												75.0000 (H11)	
Effective solar volume												75.0000 (H13)	
Daily hot water demand												107.8423 (H14)	
Volume ratio Veff/V												0.6955 (H15)	
Solar storage volume factor												0.9274 (H16)	
Solar input												-934.7031 (H17)	
Solar input	-30.7610	-43.7402	-75.1790	-101.4339	-117.9606	-127.2605	-121.0912	-110.2880	-86.6553	-59.5936	-36.3822	-24.3577 (63)	
								Solar input (sum of months) = Sum(63)m =				-934.7031 (63)	
Output from w/h													
201.9011	161.3715	138.9380	85.1444	58.8046	29.6558	28.8283	56.2286	86.1800	139.4778	175.4166	202.7536	(64)	
								Total per year (kWh/year) = Sum(64)m =				1364.7004 (64)	
Heat gains from water heating, kWh/month													
103.8872	92.1596	97.0685	84.5513	79.3202	71.9524	70.2852	76.2387	80.6132	92.0658	96.0945	102.0416	(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	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	186.0438	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5	105.5955	93.7890	76.2744	57.7446	43.1648	36.4415	39.3763	51.1829	68.6975	87.2273	101.8071	108.5304	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5	654.5176	661.3094	644.1942	607.7579	561.7636	518.5355	489.6564	482.8646	499.9798	536.4161	582.4104	625.6385	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	56.7051	(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)	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	-124.0292	(71)
Water heating gains (Table 5)	139.6334	137.1423	130.4684	117.4324	106.6131	99.9339	94.4693	102.4714	111.9628	123.7444	133.4645	137.1527	(72)
Total internal gains	1018.4662	1010.9604	969.6566	901.6546	830.2612	773.6306	742.2218	755.2386	799.3599	866.1075	936.4018	990.0413	(73)

6. Solar gains

[Jan]				Area m2	Solar flux Table 6a W/m2		g Specific data or Table 6b		FF Specific data or Table 6c		Access factor Table 6d		Gains W
Northeast				19.5900	14.6176		0.6300		0.7000		0.7700		87.5153 (75)
Southeast				2.8800	45.1778		0.6300		0.7000		0.7700		39.7640 (77)
Southwest				8.2800	45.1778		0.6300		0.7000		0.7700		114.3214 (79)
Northwest				0.8100	14.6176		0.6300		0.7000		0.7700		3.6185 (81)
Northeast				2.4300	34.0000		0.6300		0.7000		1.0000		32.7919 (82)
Southwest				2.4300	34.0000		0.6300		0.7000		1.0000		32.7919 (82)
Solar gains	310.8029	497.9971	804.9590	1187.1696	1397.8005	1589.6498	1451.2467	1274.2424	979.8146	620.8738	381.4153	245.2962	(83)
Total gains	1329.2691	1508.9576	1774.6156	2088.8241	2228.0617	2363.2804	2193.4685	2029.4810	1779.1745	1486.9813	1317.8171	1235.3375	(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	77.1952	77.5059	77.5059	77.8041	77.8041	78.2274	78.2274	78.3619	78.3619	77.9485	78.0896	77.8041
alpha	6.1463	6.1671	6.1671	6.1869	6.1869	6.2152	6.2152	6.2241	6.2241	6.1966	6.2060	6.1869
util living area	0.9991	0.9978	0.9907	0.9479	0.8092	0.5530	0.4013	0.4207	0.7577	0.9746	0.9974	0.9994 (86)
Tweekday	19.1772	19.3031	19.5552	19.8777	20.0642	20.1116	20.1137	20.1151	20.0982	19.8541	19.4740	19.1565
Tweekend	20.5271	20.5817	20.6938	20.8410	20.9383	20.9689	20.9714	20.9713	20.9553	20.8266	20.6551	20.5158
24 / 16	0	0	0	0	0	0	0	0	0	0	0	0
24 / 9	0	0	0	0	0	0	0	0	0	0	0	0
16 / 9	14	0	0	0	0	0	0	0	0	0	0	0
MIT	20.4337	20.3530	20.5275	20.7517	20.9047	20.9523	20.9558	20.9558	20.9302	20.7324	20.4615	20.2527 (87)
Th 2	20.1678	20.1709	20.1709	20.1738	20.1738	20.1779	20.1779	20.1792	20.1792	20.1752	20.1766	20.1738 (88)
util rest of house	0.9988	0.9971	0.9873	0.9288	0.7525	0.4722	0.3102	0.3227	0.6739	0.9612	0.9962	0.9992 (89)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
building certification | compliance | testing

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

Tuesday	19.1772	19.3031	19.5552	19.8777	20.0642	20.1116	20.1137	20.1151	20.0982	19.8541	19.4740	19.1565
Tuesday	19.1772	19.3031	19.5552	19.8777	20.0642	20.1116	20.1137	20.1151	20.0982	19.8541	19.4740	19.1565
MIT 2	19.1772	19.3031	19.5552	19.8777	20.0642	20.1116	20.1137	20.1151	20.0982	19.8541	19.4740	19.1565 (90)
Living area fraction									fLA = Living area / (4) =			0.0928 (91)
MIT	19.2938	19.4005	19.6454	19.9588	20.1422	20.1895	20.1918	20.1930	20.1754	19.9356	19.5656	19.2582 (92)
Temperature adjustment												0.0000
adjusted MIT	19.2938	19.4005	19.6454	19.9588	20.1422	20.1895	20.1918	20.1930	20.1754	19.9356	19.5656	19.2582 (93)

8. Space heating requirement

Utilisation	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	0.9983	0.9961	0.9843	0.9228	0.7501	0.4733	0.3117	0.3244	0.6735	0.9560	0.9950	0.9989 (94)
Useful gains	1327.0309	1503.0037	1746.7958	1927.5947	1671.3653	1118.6361	683.6908	658.2914	1198.2493	1421.6128	1311.1661	1233.9311 (95)
Ext temp.	5.3000	5.8000	7.4000	9.9000	12.9000	15.6000	17.4000	17.5000	15.1000	11.7000	8.2000	5.3000 (96)
Heat loss rate W	3474.4870	3363.3133	3028.1998	2477.9391	1784.0826	1124.4939	684.0278	658.6957	1241.3937	2025.0340	2789.6272	3438.5379 (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	1597.7074	1250.1281	953.3646	396.2480	83.8617	0.0000	0.0000	0.0000	0.0000	448.9453	1064.4920	1640.2275 (98)
Space heating												7434.9745 (98)
Space heating per m2												(98) / (4) = 26.9383 (99)

8c. Space cooling requirement

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000 (201)
Fraction of space heat from main system(s)												1.0000 (202)
Efficiency of main space heating system 1 (in %)												248.4621 (206)
Efficiency of secondary/supplementary heating system, %												100.0000 (208)
Space heating requirement												2992.3984 (211)
Space heating requirement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
	1597.7074	1250.1281	953.3646	396.2480	83.8617	0.0000	0.0000	0.0000	0.0000	448.9453	1064.4920	1640.2275 (98)
Space heating efficiency (main heating system 1)	248.4621	248.4621	248.4621	248.4621	248.4621	0.0000	0.0000	0.0000	0.0000	248.4621	248.4621	248.4621 (210)
Space heating fuel (main heating system)	643.0388	503.1465	383.7063	159.4803	33.7523	0.0000	0.0000	0.0000	0.0000	180.6897	428.4324	660.1521 (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	201.9011	161.3715	138.9380	85.1444	58.8046	29.6558	28.8283	56.2286	86.1800	139.4778	175.4166	202.7536 (64)
Efficiency of water heater (217)m	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600	159.6600 (216)
Fuel for water heating, kWh/month	126.4569	101.0720	87.0212	53.3285	36.8312	18.5744	18.0560	35.2177	53.9772	87.3593	109.8688	126.9909 (219)
Water heating fuel used												854.7541 (219)
Annual totals kWh/year												
Space heating fuel - main system												2992.3984 (211)
Space heating fuel - secondary												0.0000 (215)
Electricity for pumps and fans:												
pump for solar water heating												50.0000 (230g)
Total electricity for the above, kWh/year												50.0000 (231)
Electricity for lighting (calculated in Appendix L)												745.9401 (232)
Energy saving/generation technologies (Appendices M ,N and Q)												
PV Unit 0 (0.80 * 2.50 * 1198 * 0.80) =										-1916.1520		-1916.1520 (233)
Total delivered energy for all uses												2726.9407 (238)

10a. Fuel costs - using BEDF prices (531)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year
Space heating - main system 1	2992.3984	36.7200	1098.8087 (240)
Space heating - secondary	0.0000	0.0000	0.0000 (242)
Water heating (other fuel)	854.7541	36.7200	313.8657 (247)
Pumps and fans for heating	0.0000	0.0000	0.0000 (249)
Pump for solar water heating	50.0000	36.7200	18.3600 (249)
Energy for lighting	745.9401	36.7200	273.9092 (250)
Additional standing charges			0.0000 (251)
Energy saving/generation technologies			
PV Unit	-1916.1520	36.7200	-703.6110 (252)
Total energy cost			1001.3326 (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	2992.3984	0.5190	1553.0548 (261)

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
building certification | compliance | testing

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

Space heating - secondary	0.0000	0.5190	0.0000 (263)
Water heating (other fuel)	854.7541	0.5190	443.6174 (264)
Space and water heating			1996.6722 (265)
Pumps and fans	50.0000	0.5190	25.9500 (267)
Energy for lighting	745.9401	0.5190	387.1429 (268)
Energy saving/generation technologies			
PV Unit	-1916.1520	0.5190	-994.4829 (269)
Total kg/year			1415.2822 (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	2992.3984	3.0700	9186.6632 (261)
Space heating - secondary	0.0000	3.0700	0.0000 (263)
Water heating (other fuel)	854.7541	3.0700	2624.0950 (264)
Space and water heating			11810.7583 (265)
Pumps and fans	50.0000	3.0700	153.5000 (267)
Energy for lighting	745.9401	3.0700	2290.0363 (268)
Energy saving/generation technologies			
PV Unit	-1916.1520	3.0700	-5882.5866 (269)
Primary energy kWh/year			8371.7079 (272)
Primary energy kWh/m2/year			30.3323 (273)

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

Overheating Calculation Input Data

Dwelling type	Detached House
Number of storeys	3
Cross ventilation possible	No
SAP Region	Southern England
Front of dwelling faces	South West
Overshading	Average or unknown
Thermal mass parameter	250.0
Night ventilation	No
Ventilation rate during hot weather (ach)	5.00 (Windows fully open)

Overheating Calculation

Summer ventilation heat loss coefficient	1170.35 (P1)
Transmission heat loss coefficient	120.30 (P7)
Summer heat loss coefficient	1290.64 (P2)

Overhangs

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

Solar shading

Orientation	Z_blinds	Solar access	Z_overhangs	Z_summer
North East	1.000	0.90	1.000	0.900 (P8)
North East	1.000	1.00	1.000	1.000 (P8)
South East	1.000	0.90	1.000	0.900 (P8)
South West	1.000	0.90	1.000	0.900 (P8)
South West	1.000	1.00	1.000	1.000 (P8)
North West	1.000	0.90	1.000	0.900 (P8)

[Jul]	Area m2	Solar flux Table 6a W/m2	Specific data or Table 6b	FF Specific data or Table 6c	Shading	Gains W
North East	19.5900	106.0502	0.6300	0.7000	0.9000	742.1123
South East	2.8800	127.3119	0.6300	0.7000	0.9000	130.9740
South West	8.2800	127.3119	0.6300	0.7000	0.9000	376.5501
North West	0.8100	106.0502	0.6300	0.7000	0.9000	30.6846
North East	2.4300	217.0000	0.6300	0.7000	1.0000	209.2893
South West	2.4300	217.0000	0.6300	0.7000	1.0000	209.2893
total:						1698.8996

	Jun	Jul	Aug	
Solar gains	1838	1699	1462	(P3)
Internal gains	788	756	768	
Total summer gains	2626	2455	2230	(P5)
Summer gain/loss ratio	2.03	1.90	1.73	(P6)
Summer external temperature	15.40	17.30	17.30	
Thermal mass temperature increment (TMP = 250.0)	0.25	0.25	0.25	
Threshold temperature	17.68	19.45	19.28	(P7)
Likelihood of high internal temperature	Not significant	Not significant	Not significant	

FULL SAP CALCULATION PRINTOUT

Calculation Type: New Build (As Designed)



ENERGYREPORT
building certification | compliance | testing

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

Assessment of likelihood of high internal temperature: Not significant
