PREDICTED ENERGY ASSESSMENT

Design SAP
elmhurst energy

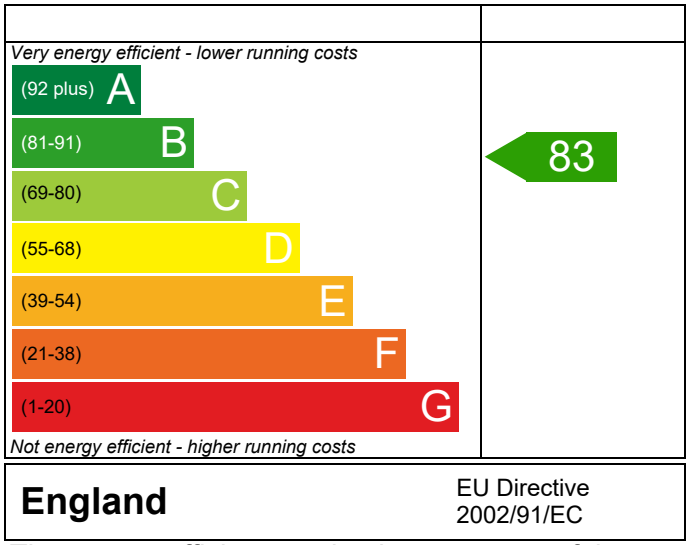
Southbourne,
PO10

Dwelling type:	Maisonette, Detached
Date of assessment:	16/11/2022
Produced by:	Gary Nicholls
Total floor area:	71.146 m²

This document is a Predicted Energy Assessment for properties marketed when they are incomplete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, this rating will be updated and an official Energy Performance Certificate will be created for the property. This will include more detailed information about the energy performance of the completed property.

The energy performance has been assessed using the Government approved SAP2012 methodology and is rated in terms of the energy use per square meter of floor area; the energy efficiency is based on fuel costs and the environmental impact is based on carbon dioxide (CO_2) emissions.

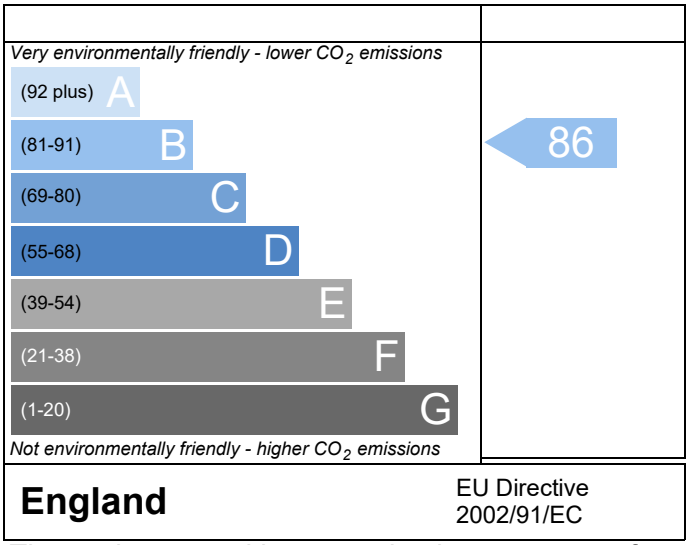
Energy Efficiency Rating



England EU Directive 2002/91/EC

The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

Environmental Impact (CO_2) Rating



England EU Directive 2002/91/EC

The environmental impact rating is a measure of a home's impact on the environment in terms of carbon dioxide (CO_2) emissions. The higher the rating the less impact it has on the environment.

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	181 - PRJ012848	**Issued on Date**	16/11/2022
Assessment Reference	181	**Prop Type Ref**	2BF03 SAT 1F 4.9
Property	Southbourne, PO10		

SAP Rating	83 B	**DER**	19.66	**TER**	19.90
Environmental	86 B	**% DER<TER**	1.23		
CO_2 Emissions (t/year)	1.11	**DFEE**	49.48	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.93		

Assessor Details	Mr. Gary Nicholls, Gary Nicholls, Tel: 02033971373, gary@briaryenergy.co.uk	**Assessor ID**	W947-0001
Client			

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

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

DWELLING AS DESIGNED

Detached Maisonette, total floor area 71 m²

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

1a TER and DER
Fuel for main heating:Mains gas
Fuel factor:1.00 (mains gas)
Target Carbon Dioxide Emission Rate (TER) 19.90 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 19.66 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)55.6 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)49.5 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 5.01 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Boiler system with radiators or underfloor - Mains gas
Data from database
Ideal LOGIC COMBI ESP1 24
Combi boiler
Efficiency: 89.6% SEDBUK2009
Minimum: 88.0% OK

Secondary heating system: None

5 Cylinder insulation
Hot water storage No cylinder

6 Controls
Space heating controls: Programmer, room thermostat and TRVs OK

Hot water controls: No cylinder

Boiler interlock Yes OK

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

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Southern England): Not significant OK
Based on:
Overshading: Average
Windows facing North: 3.54 m², No overhang
Windows facing East: 1.44 m², No overhang
Windows facing South: 0.66 m², No overhang
Windows facing West: 3.24 m², No overhang
Air change rate: 4.77 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0710 (1b)	x	1.8074 (2b)	=	7.3559	(1b) - (3b)
First floor	67.0750 (1c)	x	2.4090 (2c)	=	161.5837	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1460					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.9416	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2368	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4873	(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) =	0.4873	(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	0.6213	0.6091	0.5969	0.5360	0.5238	0.4629	0.4629	0.4507	0.4873	0.5238	0.5482	0.5725	(22b)
Effective ac	0.6930	0.6855	0.6781	0.6436	0.6372	0.6071	0.6071	0.6016	0.6187	0.6372	0.6502	0.6639	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.1000	1.2000	2.5200			(26)
Windows (Uw = 1.30)			8.8800	1.2357	10.9734			(27)
Flr - Ground			4.0710	0.1842	0.7498	75.6000	307.7676	(28a)
Brick	94.1280	10.9860	83.1420	0.2700	22.4483	107.1000	8904.5082	(29a)
Rf - Ins Joist	67.0740		67.0740	0.1100	7.3781	5.6000	375.6144	(30)
Total net area of external elements Aum(A, m2)			165.2670					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.0697			(33)
Party Floor			63.0040			20.1600	1270.1606	(32d)
Stud			146.3130			7.4000	1082.7164	(32c)
Internal Floor			67.0750			7.4000	496.3550	(32d)
Internal Ceiling			67.0750			7.4000	496.3550	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12933.4772 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.7878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6485 (36)
Total fabric heat loss	(33) + (36) =	50.7181 (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	38.6345	38.2167	37.8072	35.8837	35.5238	33.8485	33.8485	33.5383	34.4938	35.5238	36.2518	37.0130	(38)
Heat transfer coeff	89.3526	88.9348	88.5253	86.6018	86.2420	84.5667	84.5667	84.2564	85.2120	86.2420	86.9700	87.7311	(39)
Average = Sum(39)m / 12 =												86.6001	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2559	1.2500	1.2443	1.2172	1.2122	1.1886	1.1886	1.1843	1.1977	1.2122	1.2224	1.2331	(40)
HLP (average)												1.2172	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2736 (42)
Average daily hot water use (litres/day)	88.1985 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0184	93.4904	89.9625	86.4346	82.9066	79.3787	79.3787	82.9066	86.4346	89.9625	93.4904	97.0184	(44)
Energy conte	143.8755	125.8344	129.8498	113.2062	108.6241	93.7343	86.8586	99.6715	100.8619	117.5449	128.3094	139.3357	(45)
Energy content (annual)										Total = Sum(45)m =		1387.7064	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	21.5813	18.8752	19.4775	16.9809	16.2936	14.0601	13.0288	14.9507	15.1293	17.6317	19.2464	20.9004	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	16.2093	14.6053	16.1137	15.5301	16.0013	15.4316	15.9126	15.9701	15.4853	16.0672	15.6229	16.1908	(61)
Total heat required for water heating calculated for each month													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(64)
								Total per year (kWh/year) = Sum(64)m =				1576.8466	(64)
Heat gains from water heating, kWh/month													
	51.8909	45.4913	47.2035	41.5236	40.1178	35.0246	32.8587	37.1333	37.4079	43.1005	46.5686	50.3768	(65)

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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	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4906	17.3114	14.0786	10.6584	7.9673	6.7263	7.2680	9.4472	12.6801	16.1002	18.7914	20.0323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.9568	202.0318	196.8030	185.6716	171.6203	158.4139	149.5913	147.5164	152.7451	163.8765	177.9279	191.1342	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	(71)
Water heating gains (Table 5)													
	69.7459	67.6953	63.4456	57.6716	53.9218	48.6452	44.1649	49.9104	51.9554	57.9307	64.6786	67.7108	(72)
Total internal gains													
	349.2977	347.1428	334.4315	314.1060	293.6137	273.8898	261.1285	266.9783	277.4850	298.0118	321.5022	338.9817	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5420	10.6334	0.7600	0.7200	0.7700	14.2824	(74)
East	1.4400	19.6403	0.7600	0.7200	0.7700	10.7248	(76)
South	0.6620	46.7521	0.7600	0.7200	0.7700	11.7365	(78)
West	3.2400	19.6403	0.7600	0.7200	0.7700	24.1308	(80)

Solar gains	60.8744	114.7006	183.1552	265.9401	329.8978	340.6428	323.0220	273.9310	211.9394	134.1295	74.9917	50.7114	(83)
Total gains	410.1721	461.8434	517.5866	580.0461	623.5115	614.5326	584.1505	540.9094	489.4244	432.1413	396.4939	389.6931	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.2074	40.3962	40.5831	41.4845	41.6576	42.4828	42.4828	42.6393	42.1611	41.6576	41.3089	40.9505	
alpha	3.6805	3.6931	3.7055	3.7656	3.7772	3.8322	3.8322	3.8426	3.8107	3.7772	3.7539	3.7300	
util living area													
	0.9937	0.9896	0.9791	0.9488	0.8771	0.7400	0.5907	0.6461	0.8579	0.9661	0.9897	0.9948	(86)
MIT	19.2184	19.3965	19.7205	20.1755	20.5766	20.8557	20.9549	20.9364	20.7202	20.2046	19.6485	19.2065	(87)
Th 2	19.8755	19.8802	19.8847	19.9062	19.9103	19.9291	19.9291	19.9326	19.9218	19.9103	19.9021	19.8936	(88)
util rest of house													
	0.9921	0.9868	0.9733	0.9334	0.8378	0.6566	0.4663	0.5239	0.7975	0.9531	0.9866	0.9935	(89)
MIT 2	18.2579	18.4385	18.7629	19.2239	19.6021	19.8505	19.9138	19.9088	19.7457	19.2614	18.7066	18.2595	(90)
Living area fraction									fLA = Living area / (4) =			0.3013	(91)
MIT	18.5472	18.7271	19.0514	19.5106	19.8957	20.1533	20.2275	20.2184	20.0393	19.5456	18.9904	18.5448	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.3972	18.5771	18.9014	19.3606	19.7457	20.0033	20.0775	20.0684	19.8893	19.3956	18.8404	18.3948	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9891	0.9825	0.9664	0.9238	0.8307	0.6631	0.4847	0.5409	0.7953	0.9449	0.9822	0.9909	(94)
Useful gains	405.6977	453.7424	500.2163	535.8318	517.9601	407.4807	283.1561	292.5602	389.2188	408.3171	389.4557	386.1654	(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													
	1259.6244	1216.3710	1097.8383	905.9073	693.8791	456.9394	294.0769	309.0821	493.3176	758.5476	1021.0622	1245.3229	(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													
	635.3215	512.4864	444.6307	266.4543	130.8838	0.0000	0.0000	0.0000	0.0000	260.5714	454.7567	639.2132	(98)
Space heating												3344.3180	(98)
Space heating per m2											(98) / (4) =	47.0064	(99)

8c. Space cooling requirement

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3695.3790	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	635.3215	512.4864	444.6307	266.4543	130.8838	0.0000	0.0000	0.0000	0.0000	260.5714	454.7567	639.2132	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	702.0127	566.2833	491.3047	294.4247	144.6229	0.0000	0.0000	0.0000	0.0000	287.9242	502.4935	706.3129	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.8372	89.7921	89.6875	89.4321	88.9104	87.3000	87.3000	87.3000	87.3000	89.3894	89.7094	89.8554	(217)
Fuel for water heating, kWh/month													
	178.1942	156.4054	162.7468	143.9486	140.1696	125.0469	117.7220	132.4647	133.2728	149.4720	160.4428	173.0853	(219)
Water heating fuel used												1772.9711	(219)
Annual totals kWh/year													
Space heating fuel - main system												3695.3790	(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)												344.2105	(232)
Total delivered energy for all uses												5887.5606	(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	3695.3790	0.2160	798.2019	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1772.9711	0.2160	382.9618	(264)
Space and water heating			1181.1636	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	344.2105	0.5190	178.6453	(268)
Total CO2, kg/year			1398.7339	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			19.6600	(273)

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

DER		19.6600	ZC1
Total Floor Area	TFA	71.1460	
Assumed number of occupants	N	2.2736	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.6545	ZC2
CO2 emissions from cooking, equation (L16)		2.4396	ZC3
Total CO2 emissions		38.7541	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		38.7541	ZC8

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0710 (1b)	x	1.8074 (2b)	=	7.3559	(1b) - (3b)
First floor	67.0750 (1c)	x	2.4090 (2c)	=	161.5837	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1460					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.9416	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1776	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4276	(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) =	0.4276	(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	0.5452	0.5345	0.5238	0.4703	0.4596	0.4062	0.4062	0.3955	0.4276	0.4596	0.4810	0.5024	(22b)
Effective ac	0.6486	0.6428	0.6372	0.6106	0.6056	0.5825	0.5825	0.5782	0.5914	0.6056	0.6157	0.6262	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.40)			8.8800	1.3258	11.7727			(27)
Flr - Ground			4.0710	0.1300	0.5292			(28a)
Brick	94.1280	10.9860	83.1420	0.1800	14.9656			(29a)
Rf - Ins Joist	67.0740		67.0740	0.1300	8.7196			(30)
Total net area of external elements Aum(A, m2)			165.2670					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.0871			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3551	(36)
Total fabric heat loss					(33) + (36) =		46.4422	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.1599	35.8382	35.5229	34.0418	33.7647	32.4747	32.4747	32.2358	32.9716	33.7647	34.3253	34.9113	(38)
Heat transfer coeff	82.6021	82.2804	81.9651	80.4840	80.2069	78.9169	78.9169	78.6780	79.4138	80.2069	80.7675	81.3536	(39)
Average = Sum(39)m / 12 =												80.4827	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1610	1.1565	1.1521	1.1313	1.1274	1.1092	1.1092	1.1059	1.1162	1.1274	1.1352	1.1435	(40)
HLP (average)												1.1312	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2736	(42)
Average daily hot water use (litres/day)												88.1985	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0184	93.4904	89.9625	86.4346	82.9066	79.3787	79.3787	82.9066	86.4346	89.9625	93.4904	97.0184	(44)
Energy conte	143.8755	125.8344	129.8498	113.2062	108.6241	93.7343	86.8586	99.6715	100.8619	117.5449	128.3094	139.3357	(45)
Energy content (annual)										Total = Sum(45)m =		1387.7064	(45)
Distribution loss (46)m = 0.15 x (45)m	21.5813	18.8752	19.4775	16.9809	16.2936	14.0601	13.0288	14.9507	15.1293	17.6317	19.2464	20.9004	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	49.4395	43.0312	45.8439	42.6253	42.2483	39.1457	40.4505	42.2483	42.6253	45.8439	46.1049	49.4395	(61)
Total heat required for water heating calculated for each month													
	193.3150	168.8656	175.6937	155.8315	150.8724	132.8800	127.3091	141.9198	143.4872	163.3888	174.4143	188.7752	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	193.3150	168.8656	175.6937	155.8315	150.8724	132.8800	127.3091	141.9198	143.4872	163.3888	174.4143	188.7752	(64)
								Total per year (kWh/year) = Sum(64)m =				1916.7526	(64)
Heat gains from water heating, kWh/month													
	60.1985	52.5977	54.6360	48.2974	46.6796	40.9531	38.9931	43.7029	44.1929	50.5446	54.1891	58.6890	(65)

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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	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.6128	17.4199	14.1668	10.7252	8.0172	6.7685	7.3136	9.5065	12.7595	16.2012	18.9092	20.1579	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.9568	202.0318	196.8030	185.6716	171.6203	158.4139	149.5913	147.5164	152.7451	163.8765	177.9279	191.1342	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	(71)
Water heating gains (Table 5)													
	80.9119	78.2705	73.4355	67.0797	62.7414	56.8793	52.4101	58.7404	61.3790	67.9363	75.2626	78.8831	(72)
Total internal gains													
	360.5859	357.8265	344.5097	323.5809	302.4832	282.1660	269.4193	275.8676	286.9881	308.1184	332.2040	350.2795	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5420	10.6334	0.6300	0.7000	0.7700	11.5104	(74)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433	(76)
South	0.6620	46.7521	0.6300	0.7000	0.7700	9.4587	(78)
West	3.2400	19.6403	0.6300	0.7000	0.7700	19.4475	(80)

Solar gains	49.0600	92.4396	147.6086	214.3267	265.8716	274.5312	260.3302	220.7668	170.8064	108.0978	60.4374	40.8694	(83)
Total gains	409.6459	450.2661	492.1183	537.9076	568.3547	556.6972	529.7496	496.6344	457.7945	416.2162	392.6414	391.1489	(84)

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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	59.8132	60.0470	60.2780	61.3873	61.5994	62.6063	62.6063	62.7964	62.2145	61.5994	61.1718	60.7311	
alpha	4.9875	5.0031	5.0185	5.0925	5.1066	5.1738	5.1738	5.1864	5.1476	5.1066	5.0781	5.0487	
util living area													
	0.9984	0.9970	0.9929	0.9776	0.9267	0.7947	0.6281	0.6841	0.9025	0.9854	0.9969	0.9987	(86)
MIT	19.7215	19.8453	20.0765	20.4066	20.7094	20.9166	20.9807	20.9705	20.8210	20.4380	20.0321	19.7100	(87)
Th 2	19.9513	19.9550	19.9585	19.9754	19.9786	19.9933	19.9933	19.9960	19.9876	19.9786	19.9722	19.9655	(88)
util rest of house													
	0.9978	0.9960	0.9903	0.9683	0.8938	0.7091	0.4981	0.5560	0.8460	0.9776	0.9956	0.9983	(89)
MIT 2	18.2454	18.4288	18.7684	19.2565	19.6757	19.9332	19.9856	19.9828	19.8315	19.3082	18.7145	18.2386	(90)
Living area fraction									fLA = Living area / (4) =			0.3013	(91)
MIT	18.6901	18.8556	19.1625	19.6030	19.9871	20.2295	20.2854	20.2804	20.1296	19.6485	19.1114	18.6819	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6901	18.8556	19.1625	19.6030	19.9871	20.2295	20.2854	20.2804	20.1296	19.6485	19.1114	18.6819	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9968	0.9944	0.9874	0.9638	0.8942	0.7313	0.5376	0.5948	0.8555	0.9742	0.9940	0.9974	(94)
Useful gains	408.3210	447.7268	485.9322	518.4400	508.2060	407.1076	284.7969	295.3811	391.6652	405.4774	390.2666	390.1488	(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													
	1188.6541	1148.2699	1037.8831	861.4193	664.6859	444.2599	290.8412	305.3008	478.8334	725.7552	970.1333	1178.1543	(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													
	580.5678	470.7650	410.6515	246.9451	116.4211	0.0000	0.0000	0.0000	0.0000	238.2866	417.5040	586.2760	(98)
Space heating												3067.4172	(98)
Space heating per m2											(98) / (4) =	43.1144	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.4000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3284.1726	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	580.5678	470.7650	410.6515	246.9451	116.4211	0.0000	0.0000	0.0000	0.0000	238.2866	417.5040	586.2760	(98)
Space heating efficiency (main heating system 1)													
	93.4000	93.4000	93.4000	93.4000	93.4000	0.0000	0.0000	0.0000	0.0000	93.4000	93.4000	93.4000	(210)
Space heating fuel (main heating system)													
	621.5929	504.0310	439.6697	264.3952	124.6478	0.0000	0.0000	0.0000	0.0000	255.1249	447.0065	627.7045	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.3150	168.8656	175.6937	155.8315	150.8724	132.8800	127.3091	141.9198	143.4872	163.3888	174.4143	188.7752	(64)
Efficiency of water heater												80.3000	(216)
(217)m	87.6462	87.4946	87.1167	86.2050	84.4075	80.3000	80.3000	80.3000	80.3000	86.0000	87.1694	87.7129	(217)
Fuel for water heating, kWh/month													
	220.5628	193.0011	201.6763	180.7685	178.7429	165.4794	158.5419	176.7370	178.6889	189.9869	200.0867	215.2194	(219)
Water heating fuel used												2259.4918	(219)
Annual totals kWh/year													
Space heating fuel - main system												3284.1726	(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)												346.3682	(232)
Total delivered energy for all uses												5965.0326	(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	3284.1726	0.2160	709.3813	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2259.4918	0.2160	488.0502	(264)
Space and water heating			1197.4315	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	346.3682	0.5190	179.7651	(268)
Total CO2, kg/m2/year			1416.1216	(272)
Emissions per m2 for space and water heating			16.8306	(272a)
Fuel factor (mains gas)			1.0000	
Emissions per m2 for lighting			2.5267	(272b)
Emissions per m2 for pumps and fans			0.5471	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.8306 * 1.00) + 2.5267 + 0.5471, rounded to 2 d.p.			19.9000	(273)

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0710 (1b)	x	1.8074 (2b)	=	7.3579	(1b) - (3b)
First floor	67.0750 (1c)	x	2.4090 (2c)	=	161.5837	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1460					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.9416	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1776	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4281	(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) =	0.4281	(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	0.5458	0.5351	0.5244	0.4709	0.4602	0.4067	0.4067	0.3960	0.4281	0.4602	0.4816	0.5030	(22b)
Effective ac	0.6489	0.6432	0.6375	0.6109	0.6059	0.5827	0.5827	0.5784	0.5916	0.6059	0.6160	0.6265	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.1000	1.2000	2.5200			(26)
Windows (Uw = 1.30)			8.8800	1.2357	10.9734			(27)
Flr - Ground			4.0710	0.1842	0.7498	75.6000	307.7676	(28a)
Brick	94.1280	10.9860	83.1420	0.2700	22.4483	107.1000	8904.5082	(29a)
Rf - Ins Joist	67.0740		67.0740	0.1100	7.3781	5.6000	375.6144	(30)
Total net area of external elements Aum(A, m2)			165.2670					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.0697			(33)
Party Floor			63.0040			20.1600	1270.1606	(32d)
Stud			146.3130			7.4000	1082.7164	(32c)
Internal Floor			67.0750			7.4000	496.3550	(32d)
Internal Ceiling			67.0750			7.4000	496.3550	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12933.4772 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.7878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6485 (36)
Total fabric heat loss	(33) + (36) =	50.7181 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.1793	35.8568	35.5408	34.0562	33.7785	32.4855	32.4855	32.2460	32.9835	33.7785	34.3404	34.9278	(38)
Heat transfer coeff	86.8974	86.5750	86.2589	84.7743	84.4966	83.2036	83.2036	82.9642	83.7016	84.4966	85.0585	85.6459	(39)
Average = Sum(39)m / 12 =												84.7730	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2214	1.2169	1.2124	1.1916	1.1877	1.1695	1.1695	1.1661	1.1765	1.1877	1.1955	1.2038	(40)
HLP (average)												1.1915	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2736 (42)
Average daily hot water use (litres/day)	88.1985 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0184	93.4904	89.9625	86.4346	82.9066	79.3787	79.3787	82.9066	86.4346	89.9625	93.4904	97.0184	(44)
Energy conte	143.8755	125.8344	129.8498	113.2062	108.6241	93.7343	86.8586	99.6715	100.8619	117.5449	128.3094	139.3357	(45)
Energy content (annual)										Total = Sum(45)m =		1387.7064	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF FABRIC ENERGY EFFICIENCY 09 Jan 2014

	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.5735	26.7398	27.5931	24.0563	23.0826	19.9185	18.4575	21.1802	21.4332	24.9783	27.2657	29.6088	(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	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4906	17.3114	14.0786	10.6584	7.9673	6.7263	7.2680	9.4472	12.6801	16.1002	18.7914	20.0323	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.9568	202.0318	196.8030	185.6716	171.6203	158.4139	149.5913	147.5164	152.7451	163.8765	177.9279	191.1342	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	(71)
Water heating gains (Table 5)													
	41.0935	39.7914	37.0875	33.4116	31.0250	27.6646	24.8084	28.4680	29.7683	33.5730	37.8691	39.7968	(72)
Total internal gains													
	317.6453	316.2389	305.0734	286.8459	267.7169	249.9092	238.7721	242.5360	252.2978	270.6541	291.6927	308.0677	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5420	10.6334	0.7600	0.7200	0.7700	14.2824	(74)
East	1.4400	19.6403	0.7600	0.7200	0.7700	10.7248	(76)
South	0.6620	46.7521	0.7600	0.7200	0.7700	11.7365	(78)
West	3.2400	19.6403	0.7600	0.7200	0.7700	24.1308	(80)

Solar gains	60.8744	114.7006	183.1552	265.9401	329.8978	340.6428	323.0220	273.9310	211.9394	134.1295	74.9917	50.7114	(83)
Total gains	378.5197	430.9395	488.2286	552.7860	597.6147	590.5520	561.7941	516.4670	464.2372	404.7836	366.6844	358.7791	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.3434	41.4974	41.6494	42.3788	42.5181	43.1788	43.1788	43.3034	42.9219	42.5181	42.2372	41.9475	
alpha	3.7562	3.7665	3.7766	3.8253	3.8345	3.8786	3.8786	3.8869	3.8615	3.8345	3.8158	3.7965	
util living area													
	0.9952	0.9917	0.9823	0.9544	0.8858	0.7520	0.6024	0.6618	0.8709	0.9717	0.9921	0.9961	(86)
MIT	19.2211	19.3982	19.7206	20.1695	20.5721	20.8519	20.9537	20.9332	20.7102	20.1901	19.6367	19.2023	(87)
Th 2	19.9029	19.9065	19.9101	19.9268	19.9299	19.9445	19.9445	19.9472	19.9389	19.9299	19.9236	19.9170	(88)
util rest of house													
	0.9940	0.9895	0.9774	0.9405	0.8486	0.6704	0.4784	0.5404	0.8142	0.9607	0.9896	0.9951	(89)
MIT 2	18.2811	18.4600	18.7827	19.2351	19.6157	19.8628	19.9286	19.9217	19.7536	19.2634	18.7113	18.2728	(90)
Living area fraction									fLA = Living area / (4) =			0.3013	(91)
MIT	18.5643	18.7427	19.0653	19.5166	19.9039	20.1608	20.2374	20.2265	20.0418	19.5425	18.9901	18.5529	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5643	18.7427	19.0653	19.5166	19.9039	20.1608	20.2374	20.2265	20.0418	19.5425	18.9901	18.5529	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9863	0.9723	0.9339	0.8475	0.6889	0.5150	0.5753	0.8207	0.9554	0.9866	0.9934	(94)
Useful gains	375.4556	425.0355	474.7290	516.2621	506.4866	406.8057	289.3173	297.1236	381.0076	386.7391	361.7783	356.4040	(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													
	1239.5272	1198.4273	1083.8656	900.0181	693.1983	462.6757	302.6439	317.4591	497.3398	755.6150	1011.3538	1229.2631	(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													
	642.8693	519.7193	453.1976	276.3043	138.9135	0.0000	0.0000	0.0000	0.0000	274.4437	467.6944	649.4072	(98)
Space heating												3422.5492	(98)
Space heating per m2											(98) / (4) =	48.1060	(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	782.1138	615.7066	630.5275	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.7916	0.8611	0.8290	0.0000	0.0000	0.0000	0.0000	(101)

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Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	619.1314	530.1810	522.6830	0.0000	0.0000	0.0000	0.0000 (102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	775.4609	740.1951	688.8268	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	112.5572	156.2505	123.6110	0.0000	0.0000	0.0000	0.0000 (104)
Space cooling												392.4186 (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	28.1393	39.0626	30.9027	0.0000	0.0000	0.0000	0.0000 (107)
Space cooling												98.1047 (107)
Space cooling per m2												1.3789 (108)
Energy for space heating												48.1060 (99)
Energy for space cooling												1.3789 (108)
Total												49.4849 (109)
Dwelling Fabric Energy Efficiency (DFEE)												49.5 (109)

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SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
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1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0710 (1b)	x	1.8074 (2b)	=	7.3559	(1b) - (3b)
First floor	67.0750 (1c)	x	2.4090 (2c)	=	161.5837	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1460					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.9416	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1776	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4276	(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) =	0.4276	(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	0.5452	0.5345	0.5238	0.4703	0.4596	0.4062	0.4062	0.3955	0.4276	0.4596	0.4810	0.5024	(22b)
Effective ac	0.6486	0.6428	0.6372	0.6106	0.6056	0.5825	0.5825	0.5782	0.5914	0.6056	0.6157	0.6262	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1000	1.0000	2.1000			(26)
TER Opening Type (Uw = 1.40)			8.8800	1.3258	11.7727			(27)
Flr - Ground			4.0710	0.1300	0.5292			(28a)
Brick	94.1280	10.9860	83.1420	0.1800	14.9656			(29a)
Rf - Ins Joist	67.0740		67.0740	0.1300	8.7196			(30)
Total net area of external elements Aum(A, m2)			165.2670					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		38.0871			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.3551	(36)
Total fabric heat loss					(33) + (36) =		46.4422	(37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.1599	35.8382	35.5229	34.0418	33.7647	32.4747	32.4747	32.2358	32.9716	33.7647	34.3253	34.9113	(38)
Heat transfer coeff	82.6021	82.2804	81.9651	80.4840	80.2069	78.9169	78.9169	78.6780	79.4138	80.2069	80.7675	81.3536	(39)
Average = Sum(39)m / 12 =												80.4827	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1610	1.1565	1.1521	1.1313	1.1274	1.1092	1.1092	1.1059	1.1162	1.1274	1.1352	1.1435	(40)
HLP (average)												1.1312	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												2.2736	(42)
Average daily hot water use (litres/day)												88.1985	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0184	93.4904	89.9625	86.4346	82.9066	79.3787	79.3787	82.9066	86.4346	89.9625	93.4904	97.0184	(44)
Energy conte	143.8755	125.8344	129.8498	113.2062	108.6241	93.7343	86.8586	99.6715	100.8619	117.5449	128.3094	139.3357	(45)
Energy content (annual)										Total = Sum(45)m =		1387.7064	(45)
Distribution loss (46)m = 0.15 x (45)m	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(46)
Water storage loss:													
Total storage loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													

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	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Primary loss	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(59)
Heat gains from water heating, kWh/month													
	30.5735	26.7398	27.5931	24.0563	23.0826	19.9185	18.4575	21.1802	21.4332	24.9783	27.2657	29.6088	(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	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	113.6811	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.6128	17.4199	14.1668	10.7252	8.0172	6.7685	7.3136	9.5065	12.7595	16.2012	18.9092	20.1579	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	199.9568	202.0318	196.8030	185.6716	171.6203	158.4139	149.5913	147.5164	152.7451	163.8765	177.9279	191.1342	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	34.3681	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	(71)
Water heating gains (Table 5)													
	41.0935	39.7914	37.0875	33.4116	31.0250	27.6646	24.8084	28.4680	29.7683	33.5730	37.8691	39.7968	(72)
Total internal gains													
	317.7674	316.3474	305.1617	286.9127	267.7668	249.9514	238.8176	242.5952	252.3773	270.7550	291.8105	308.1933	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5420	10.6334	0.6300	0.7000	0.7700	11.5104	(74)
East	1.4400	19.6403	0.6300	0.7000	0.7700	8.6433	(76)
South	0.6620	46.7521	0.6300	0.7000	0.7700	9.4587	(78)
West	3.2400	19.6403	0.6300	0.7000	0.7700	19.4475	(80)

Solar gains	49.0600	92.4396	147.6086	214.3267	265.8716	274.5312	260.3302	220.7668	170.8064	108.0978	60.4374	40.8694	(83)
Total gains	366.8274	408.7870	452.7703	501.2395	533.6384	524.4826	499.1479	463.3620	423.1837	378.8528	352.2479	349.0627	(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	59.8132	60.0470	60.2780	61.3873	61.5994	62.6063	62.6063	62.7964	62.2145	61.5994	61.1718	60.7311	
alpha	4.9875	5.0031	5.0185	5.0925	5.1066	5.1738	5.1738	5.1864	5.1476	5.1066	5.0781	5.0487	
util living area													
	0.9990	0.9981	0.9951	0.9832	0.9409	0.8218	0.6594	0.7205	0.9243	0.9902	0.9981	0.9992	(86)
MIT	19.6655	19.7913	20.0263	20.3628	20.6768	20.9015	20.9759	20.9626	20.7917	20.3916	19.9794	19.6547	(87)
Th 2	19.9513	19.9550	19.9585	19.9754	19.9786	19.9933	19.9933	19.9960	19.9876	19.9786	19.9722	19.9655	(88)
util rest of house													
	0.9987	0.9974	0.9932	0.9759	0.9127	0.7399	0.5264	0.5913	0.8761	0.9848	0.9973	0.9990	(89)
MIT 2	18.7307	18.8593	19.0963	19.4426	19.7440	19.9433	19.9866	19.9841	19.8590	19.4760	19.0610	18.7313	(90)
Living area fraction										fLA = Living area / (4) =		0.3013	(91)
MIT	19.0123	19.1401	19.3765	19.7199	20.0250	20.2320	20.2846	20.2789	20.1400	19.7519	19.3377	19.0095	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.0123	19.1401	19.3765	19.7199	20.0250	20.2320	20.2846	20.2789	20.1400	19.7519	19.3377	19.0095	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9982	0.9966	0.9918	0.9736	0.9143	0.7617	0.5672	0.6307	0.8850	0.9832	0.9966	0.9986	(94)
Useful gains	366.1755	407.4132	449.0494	488.0118	487.8880	399.4776	283.0927	292.2647	374.4986	372.4841	351.0432	348.5859	(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													
	1215.2714	1171.6796	1055.4208	870.8265	667.7257	444.4606	290.7806	305.1858	479.6605	734.0418	988.4089	1204.8021	(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													
	631.7273	513.5870	451.1403	275.6266	133.7992	0.0000	0.0000	0.0000	0.0000	268.9989	458.9033	637.0249	(98)
Space heating												3370.8075	(98)
Space heating per m2											(98) / (4) =	47.3787	(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	741.8192	583.9853	597.9532	0.0000	0.0000	0.0000	0.0000	(100)
Utilisation	0.0000	0.0000	0.0000	0.0000	0.0000	0.8117	0.8882	0.8575	0.0000	0.0000	0.0000	0.0000	(101)
Useful loss	0.0000	0.0000	0.0000	0.0000	0.0000	602.1088	518.7223	512.7210	0.0000	0.0000	0.0000	0.0000	(102)
Total gains	0.0000	0.0000	0.0000	0.0000	0.0000	698.2930	667.0329	626.8348	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	69.2526	110.3430	84.9007	0.0000	0.0000	0.0000	0.0000	(104)

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Space cooling                                                                                                      264.4963 (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    17.3131    27.5858    21.2252     0.0000     0.0000     0.0000     0.0000 (107)
Space cooling                                                                                                       66.1241 (107)
Space cooling per m2                                                                                                 0.9294 (108)
Energy for space heating                                                                                            47.3787 (99)
Energy for space cooling                                                                                             0.9294 (108)
Total                                                                                                               48.3081 (109)
Target Fabric Energy Efficiency (TFEE)                                                                                 55.6 (109)


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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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0710	(1b)	x 1.8074	(2b) =	7.3559	(1b) - (3b)
First floor	67.0750	(1c)	x 2.4090	(2c) =	161.5837	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1460					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.9416	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2368	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4873	(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) =	0.4873	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.5604	0.5116	0.4994	0.4873	0.5116	0.4507	0.4751	0.4507	0.4507	0.4873	0.4751	0.4994	(22b)
Effective ac	0.6570	0.6309	0.6247	0.6187	0.6309	0.6016	0.6129	0.6016	0.6016	0.6187	0.6129	0.6247	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.1000	1.2000	2.5200			(26)
Windows (Uw = 1.30)			8.8800	1.2357	10.9734			(27)
Flr - Ground			4.0710	0.1842	0.7498	75.6000	307.7676	(28a)
Brick	94.1280	10.9860	83.1420	0.2700	22.4483	107.1000	8904.5082	(29a)
Rf - Ins Joist	67.0740		67.0740	0.1100	7.3781	5.6000	375.6144	(30)
Total net area of external elements Aum(A, m2)			165.2670					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.0697			(33)
Party Floor			63.0040			20.1600	1270.1606	(32d)
Stud			146.3130			7.4000	1082.7164	(32c)
Internal Floor			67.0750			7.4000	496.3550	(32d)
Internal Ceiling			67.0750			7.4000	496.3550	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12933.4772 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.7878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6485 (36)
Total fabric heat loss	(33) + (36) =	50.7181 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.6283	35.1722	34.8289	34.4938	35.1722	33.5383	34.1670	33.5383	33.5383	34.4938	34.1670	34.8289	(38)
Heat transfer coeff	87.3464	85.8903	85.5470	85.2120	85.8903	84.2564	84.8852	84.2564	84.2564	85.2120	84.8852	85.5470	(39)
Average = Sum(39)m / 12 =												85.2654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2277	1.2072	1.2024	1.1977	1.2072	1.1843	1.1931	1.1843	1.1843	1.1977	1.1931	1.2024	(40)
HLP (average)												1.1985	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2736 (42)
Average daily hot water use (litres/day)	88.1985 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0184	93.4904	89.9625	86.4346	82.9066	79.3787	79.3787	82.9066	86.4346	89.9625	93.4904	97.0184	(44)
Energy conte	143.8755	125.8344	129.8498	113.2062	108.6241	93.7343	86.8586	99.6715	100.8619	117.5449	128.3094	139.3357	(45)
Energy content (annual)										Total = Sum(45)m =		1387.7064	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF HEAT DEMAND 09 Jan 2014

	21.5813	18.8752	19.4775	16.9809	16.2936	14.0601	13.0288	14.9507	15.1293	17.6317	19.2464	20.9004	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	16.2093	14.6053	16.1137	15.5301	16.0013	15.4316	15.9126	15.9701	15.4853	16.0672	15.6229	16.1908	(61)
Total heat required for water heating calculated for each month													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(64)
								Total per year (kWh/year) = Sum(64)m =				1576.8466	(64)
RHI water heating demand												1577	(64)
Heat gains from water heating, kWh/month													
	51.8909	45.4913	47.2035	41.5236	40.1178	35.0246	32.8587	37.1333	37.4079	43.1005	46.5686	50.3768	(65)

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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	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7266	43.2785	35.1964	26.6460	19.9182	16.8158	18.1700	23.6181	31.7001	40.2506	46.9784	50.0808	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.4430	301.5399	293.7358	277.1218	256.1496	236.4387	223.2706	220.1737	227.9778	244.5918	265.5640	285.2749	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	(71)
Water heating gains (Table 5)													
	69.7459	67.6953	63.4456	57.6716	53.9218	48.6452	44.1649	49.9104	51.9554	57.9307	64.6786	67.7108	(72)
Total internal gains													
	516.3033	511.9016	491.7656	460.8273	429.3774	401.2875	384.9933	393.0900	411.0212	442.1610	476.6089	502.4544	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5420	14.6401	0.7600	0.7200	0.7700	19.6640	(74)
East	1.4400	27.3735	0.7600	0.7200	0.7700	14.9476	(76)
South	0.6620	61.3950	0.7600	0.7200	0.7700	15.4124	(78)
West	3.2400	27.3735	0.7600	0.7200	0.7700	33.6321	(80)

Solar gains	83.6561	129.9098	207.4298	308.4681	368.9511	407.1786	386.1374	328.5866	255.5210	162.2972	98.8899	67.5415	(83)
Total gains	599.9593	641.8114	699.1955	769.2954	798.3285	808.4662	771.1307	721.6766	666.5422	604.4582	575.4988	569.9958	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.1309	41.8281	41.9960	42.1611	41.8281	42.6393	42.3234	42.6393	42.6393	42.1611	42.3234	41.9960	
alpha	3.7421	3.7885	3.7997	3.8107	3.7885	3.8426	3.8216	3.8426	3.8426	3.8107	3.8216	3.7997	
util living area													
	0.9740	0.9650	0.9369	0.8651	0.7282	0.5171	0.3584	0.3682	0.6487	0.8746	0.9545	0.9765	(86)
MIT	19.6989	19.8460	20.1547	20.5334	20.8242	20.9664	20.9938	20.9935	20.9200	20.6034	20.1330	19.7207	(87)
Th 2	19.8979	19.9142	19.9181	19.9218	19.9142	19.9326	19.9255	19.9326	19.9326	19.9218	19.9255	19.9181	(88)
util rest of house													
	0.9676	0.9565	0.9211	0.8313	0.6619	0.4209	0.2441	0.2481	0.5520	0.8335	0.9413	0.9706	(89)
MIT 2	18.7496	18.9060	19.2083	19.5649	19.8055	19.9194	19.9244	19.9315	19.8952	19.6368	19.1979	18.7871	(90)
Living area fraction									fLA = Living area / (4) =			0.3013	(91)
MIT	19.0356	19.1892	19.4934	19.8567	20.1124	20.2348	20.2466	20.2515	20.2040	19.9280	19.4796	19.0683	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8856	19.0392	19.3434	19.7067	19.9624	20.0848	20.0966	20.1015	20.0540	19.7780	19.3296	18.9183	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9599	0.9478	0.9109	0.8236	0.6651	0.4352	0.2626	0.2674	0.5639	0.8269	0.9320	0.9635	(94)
Useful gains	575.9014	608.3004	636.8788	633.5626	530.9814	351.8180	202.5116	193.0030	375.8723	499.8553	536.3538	549.2020	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	1186.6528	1145.7089	1021.7218	835.6452	598.0039	361.0237	203.4333	193.9137	400.5540	662.7769	927.7615	1147.8988	(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													
	454.3991	361.1385	286.3232	145.4995	49.8648	0.0000	0.0000	0.0000	0.0000	121.2137	281.8136	445.4304	(98)
Space heating												2145.6827	(98)
RHI space heating demand												2146	(98)

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0710	(1b)	x 1.8074	(2b) =	7.3559	(1b) - (3b)
First floor	67.0750	(1c)	x 2.4090	(2c) =	161.5837	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1460					(4)
Dwelling volume				(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =	168.9416	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2368	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4873	(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) =	0.4873	(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	0.6213	0.6091	0.5969	0.5360	0.5238	0.4629	0.4629	0.4507	0.4873	0.5238	0.5482	0.5725	(22b)
Effective ac	0.6930	0.6855	0.6781	0.6436	0.6372	0.6071	0.6071	0.6016	0.6187	0.6372	0.6502	0.6639	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.1000	1.2000	2.5200			(26)
Windows (Uw = 1.30)			8.8800	1.2357	10.9734			(27)
Flr - Ground			4.0710	0.1842	0.7498	75.6000	307.7676	(28a)
Brick	94.1280	10.9860	83.1420	0.2700	22.4483	107.1000	8904.5082	(29a)
Rf - Ins Joist	67.0740		67.0740	0.1100	7.3781	5.6000	375.6144	(30)
Total net area of external elements Aum(A, m2)			165.2670					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.0697			(33)
Party Floor			63.0040			20.1600	1270.1606	(32d)
Stud			146.3130			7.4000	1082.7164	(32c)
Internal Floor			67.0750			7.4000	496.3550	(32d)
Internal Ceiling			67.0750			7.4000	496.3550	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12933.4772 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.7878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6485 (36)
Total fabric heat loss	(33) + (36) =	50.7181 (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	38.6345	38.2167	37.8072	35.8837	35.5238	33.8485	33.8485	33.5383	34.4938	35.5238	36.2518	37.0130	(38)
Heat transfer coeff	89.3526	88.9348	88.5253	86.6018	86.2420	84.5667	84.5667	84.2564	85.2120	86.2420	86.9700	87.7311	(39)
Average = Sum(39)m / 12 =												86.6001	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2559	1.2500	1.2443	1.2172	1.2122	1.1886	1.1886	1.1843	1.1977	1.2122	1.2224	1.2331	(40)
HLP (average)												1.2172	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2736 (42)
Average daily hot water use (litres/day)	88.1985 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0184	93.4904	89.9625	86.4346	82.9066	79.3787	79.3787	82.9066	86.4346	89.9625	93.4904	97.0184	(44)
Energy conte	143.8755	125.8344	129.8498	113.2062	108.6241	93.7343	86.8586	99.6715	100.8619	117.5449	128.3094	139.3357	(45)
Energy content (annual)										Total = Sum(45)m =		1387.7064	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF ENERGY RATINGS 09 Jan 2014

	21.5813	18.8752	19.4775	16.9809	16.2936	14.0601	13.0288	14.9507	15.1293	17.6317	19.2464	20.9004	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	16.2093	14.6053	16.1137	15.5301	16.0013	15.4316	15.9126	15.9701	15.4853	16.0672	15.6229	16.1908	(61)
Total heat required for water heating calculated for each month													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(64)
								Total per year (kWh/year) = Sum(64)m =				1576.8466	(64)
Heat gains from water heating, kWh/month													
	51.8909	45.4913	47.2035	41.5236	40.1178	35.0246	32.8587	37.1333	37.4079	43.1005	46.5686	50.3768	(65)

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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	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7266	43.2785	35.1964	26.6460	19.9182	16.8158	18.1700	23.6181	31.7001	40.2506	46.9784	50.0808	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.4430	301.5399	293.7358	277.1218	256.1496	236.4387	223.2706	220.1737	227.9778	244.5918	265.5640	285.2749	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	(71)
Water heating gains (Table 5)													
	69.7459	67.6953	63.4456	57.6716	53.9218	48.6452	44.1649	49.9104	51.9554	57.9307	64.6786	67.7108	(72)
Total internal gains													
	516.3033	511.9016	491.7656	460.8273	429.3774	401.2875	384.9933	393.0900	411.0212	442.1610	476.6089	502.4544	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5420	10.6334	0.7600	0.7200	0.7700	14.2824	(74)
East	1.4400	19.6403	0.7600	0.7200	0.7700	10.7248	(76)
South	0.6620	46.7521	0.7600	0.7200	0.7700	11.7365	(78)
West	3.2400	19.6403	0.7600	0.7200	0.7700	24.1308	(80)

Solar gains	60.8744	114.7006	183.1552	265.9401	329.8978	340.6428	323.0220	273.9310	211.9394	134.1295	74.9917	50.7114	(83)
Total gains	577.1777	626.6021	674.9208	726.7674	759.2752	741.9303	708.0153	667.0210	622.9606	576.2905	551.6005	553.1658	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	40.2074	40.3962	40.5831	41.4845	41.6576	42.4828	42.4828	42.6393	42.1611	41.6576	41.3089	40.9505	
alpha	3.6805	3.6931	3.7055	3.7656	3.7772	3.8322	3.8322	3.8426	3.8107	3.7772	3.7539	3.7300	
util living area													
	0.9812	0.9729	0.9540	0.9064	0.8118	0.6542	0.5034	0.5485	0.7686	0.9235	0.9707	0.9837	(86)
MIT	19.4791	19.6475	19.9463	20.3551	20.6919	20.9068	20.9738	20.9637	20.8183	20.3949	19.8853	19.4648	(87)
Th 2	19.8755	19.8802	19.8847	19.9062	19.9103	19.9291	19.9291	19.9326	19.9218	19.9103	19.9021	19.8936	(88)
util rest of house													
	0.9767	0.9664	0.9425	0.8821	0.7622	0.5686	0.3906	0.4349	0.6940	0.8985	0.9625	0.9798	(89)
MIT 2	18.5154	18.6848	18.9808	19.3890	19.6957	19.8811	19.9207	19.9200	19.8157	19.4372	18.9380	18.5151	(90)
Living area fraction									fLA = Living area / (4) =			0.3013	(91)
MIT	18.8057	18.9748	19.2717	19.6801	19.9958	20.1901	20.2380	20.2344	20.1178	19.7257	19.2234	18.8012	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.6557	18.8248	19.1217	19.5301	19.8458	20.0401	20.0880	20.0844	19.9678	19.5757	19.0734	18.6512	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9702	0.9584	0.9326	0.8721	0.7589	0.5782	0.4080	0.4519	0.6976	0.8891	0.9545	0.9739	(94)
Useful gains	559.9714	600.5290	629.4046	633.8166	576.2212	428.9674	288.8755	301.4312	434.5963	512.3688	526.4954	538.7446	(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													
	1282.7224	1238.4016	1117.3403	920.5823	702.5111	460.0516	294.9686	310.4351	500.0064	774.0861	1041.3249	1267.8223	(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													
	537.7267	428.6504	363.0242	206.4713	93.9597	0.0000	0.0000	0.0000	0.0000	194.7177	370.6773	542.4339	(98)
Space heating												2737.6610	(98)
Space heating per m2											(98) / (4) =	38.4795	(99)

8c. Space cooling requirement

CALCULATION OF ENERGY RATINGS 09 Jan 2014

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												90.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												3025.0398	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	537.7267	428.6504	363.0242	206.4713	93.9597	0.0000	0.0000	0.0000	0.0000	194.7177	370.6773	542.4339	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000		(210)
Space heating fuel (main heating system)													
	594.1732	473.6468	401.1317	228.1451	103.8228	0.0000	0.0000	0.0000	0.0000	215.1577	409.5881	599.3744	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.7453	89.6887	89.5586	89.2437	88.6474	87.3000	87.3000	87.3000	87.3000	89.1699	89.5816	89.7668	(217)
Fuel for water heating, kWh/month													
	178.3767	156.5857	162.9811	144.2526	140.5855	125.0469	117.7220	132.4647	133.2728	149.8399	160.6718	173.2562	(219)
Water heating fuel used												1775.0558	(219)
Annual totals kWh/year													
Space heating fuel - main system												3025.0398	(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)												344.2105	(232)
Total delivered energy for all uses												5219.3061	(238)

10a. Fuel costs - using Table 12 prices

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	3025.0398	3.4800	105.2714	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1775.0558	3.4800	61.7719	(247)
Pumps and fans for heating	75.0000	13.1900	9.8925	(249)
Energy for lighting	344.2105	13.1900	45.4014	(250)
Additional standing charges			120.0000	(251)
Total energy cost			342.3372	(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] =	1.2379	(257)
SAP value		82.7308	
SAP rating (Section 12)		83	(258)
SAP band		B	

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

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3025.0398	0.2160	653.4086	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1775.0558	0.2160	383.4120	(264)
Space and water heating			1036.8206	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	344.2105	0.5190	178.6453	(268)
Total kg/year			1254.3909	(272)
CO2 emissions per m2			17.6300	(273)
EI value			85.5278	
EI rating			86	(274)
EI band			B	

Calculation of stars for heating and DHW

Main heating energy efficiency	3.48 × (1 + 0.29 × 0.00) / 0.9050 = 3.845, stars = 4
Main heating environmental impact	0.216 × (1 + 0.29 × 0.00) / 0.9050 = 0.2387, stars = 4
Water heating energy efficiency	3.48 / 0.8872 = 3.923, stars = 4
Water heating environmental impact	0.216 / 0.8872 = 0.2435, stars = 4

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 (m2)		Storey height (m)		Volume (m3)	
Ground floor	4.0710 (1b)	x	1.8074 (2b)	=	7.3579	(1b) - (3b)
First floor	67.0750 (1c)	x	2.4090 (2c)	=	161.5837	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	71.1460					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	168.9416	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.2368	(8)
Pressure test		Yes	
Measured/design AP50		5.0100	
Infiltration rate		0.4873	(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) =	0.4873	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	4.6000	4.2000	4.1000	4.0000	4.2000	3.7000	3.9000	3.7000	3.7000	4.0000	3.9000	4.1000	(22)
Wind factor	1.1500	1.0500	1.0250	1.0000	1.0500	0.9250	0.9750	0.9250	0.9250	1.0000	0.9750	1.0250	(22a)
Adj infilt rate	0.5604	0.5116	0.4994	0.4873	0.5116	0.4507	0.4751	0.4507	0.4507	0.4873	0.4751	0.4994	(22b)
Effective ac	0.6570	0.6309	0.6247	0.6187	0.6309	0.6016	0.6129	0.6016	0.6016	0.6187	0.6129	0.6247	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Solid Door			2.1000	1.2000	2.5200			(26)
Windows (Uw = 1.30)			8.8800	1.2357	10.9734			(27)
Flr - Ground			4.0710	0.1842	0.7498	75.6000	307.7676	(28a)
Brick	94.1280	10.9860	83.1420	0.2700	22.4483	107.1000	8904.5082	(29a)
Rf - Ins Joist	67.0740		67.0740	0.1100	7.3781	5.6000	375.6144	(30)
Total net area of external elements Aum(A, m2)			165.2670					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		44.0697			(33)
Party Floor			63.0040			20.1600	1270.1606	(32d)
Stud			146.3130			7.4000	1082.7164	(32c)
Internal Floor			67.0750			7.4000	496.3550	(32d)
Internal Ceiling			67.0750			7.4000	496.3550	(32e)

Heat capacity Cm = Sum(A x k)	(28)...(30) + (32) + (32a)...(32e) =	12933.4772 (34)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		181.7878 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		6.6485 (36)
Total fabric heat loss	(33) + (36) =	50.7181 (37)

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

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	36.6283	35.1722	34.8289	34.4938	35.1722	33.5383	34.1670	33.5383	33.5383	34.4938	34.1670	34.8289	(38)
Heat transfer coeff	87.3464	85.8903	85.5470	85.2120	85.8903	84.2564	84.8852	84.2564	84.2564	85.2120	84.8852	85.5470	(39)
Average = Sum(39)m / 12 =												85.2654	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2277	1.2072	1.2024	1.1977	1.2072	1.1843	1.1931	1.1843	1.1843	1.1977	1.1931	1.2024	(40)
HLP (average)												1.1985	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.2736 (42)
Average daily hot water use (litres/day)	88.1985 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	97.0184	93.4904	89.9625	86.4346	82.9066	79.3787	79.3787	82.9066	86.4346	89.9625	93.4904	97.0184	(44)
Energy conte	143.8755	125.8344	129.8498	113.2062	108.6241	93.7343	86.8586	99.6715	100.8619	117.5449	128.3094	139.3357	(45)
Energy content (annual)										Total = Sum(45)m =		1387.7064	(45)

Distribution loss (46)m = 0.15 x (45)m

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

	21.5813	18.8752	19.4775	16.9809	16.2936	14.0601	13.0288	14.9507	15.1293	17.6317	19.2464	20.9004	(46)
Water storage loss:													
Total storage loss													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(56)
If cylinder contains dedicated solar storage													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(57)
Combi loss	16.2093	14.6053	16.1137	15.5301	16.0013	15.4316	15.9126	15.9701	15.4853	16.0672	15.6229	16.1908	(61)
Total heat required for water heating calculated for each month													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(64)
								Total per year (kWh/year) = Sum(64)m =				1576.8466	(64)
Heat gains from water heating, kWh/month													
	51.8909	45.4913	47.2035	41.5236	40.1178	35.0246	32.8587	37.1333	37.4079	43.1005	46.5686	50.3768	(65)

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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	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	136.4173	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	48.7266	43.2785	35.1964	26.6460	19.9182	16.8158	18.1700	23.6181	31.7001	40.2506	46.9784	50.0808	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.4430	301.5399	293.7358	277.1218	256.1496	236.4387	223.2706	220.1737	227.9778	244.5918	265.5640	285.2749	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	50.9154	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	-90.9449	(71)
Water heating gains (Table 5)													
	69.7459	67.6953	63.4456	57.6716	53.9218	48.6452	44.1649	49.9104	51.9554	57.9307	64.6786	67.7108	(72)
Total internal gains													
	516.3033	511.9016	491.7656	460.8273	429.3774	401.2875	384.9933	393.0900	411.0212	442.1610	476.6089	502.4544	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	3.5420	14.6401	0.7600	0.7200	0.7700	19.6640	(74)
East	1.4400	27.3735	0.7600	0.7200	0.7700	14.9476	(76)
South	0.6620	61.3950	0.7600	0.7200	0.7700	15.4124	(78)
West	3.2400	27.3735	0.7600	0.7200	0.7700	33.6321	(80)

Solar gains	83.6561	129.9098	207.4298	308.4681	368.9511	407.1786	386.1374	328.5866	255.5210	162.2972	98.8899	67.5415	(83)
Total gains	599.9593	641.8114	699.1955	769.2954	798.3285	808.4662	771.1307	721.6766	666.5422	604.4582	575.4988	569.9958	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	41.1309	41.8281	41.9960	42.1611	41.8281	42.6393	42.3234	42.6393	42.6393	42.1611	42.3234	41.9960	
alpha	3.7421	3.7885	3.7997	3.8107	3.7885	3.8426	3.8216	3.8426	3.8426	3.8107	3.8216	3.7997	
util living area													
	0.9740	0.9650	0.9369	0.8651	0.7282	0.5171	0.3584	0.3682	0.6487	0.8746	0.9545	0.9765	(86)
MIT	19.6989	19.8460	20.1547	20.5334	20.8242	20.9664	20.9938	20.9935	20.9200	20.6034	20.1330	19.7207	(87)
Th 2	19.8979	19.9142	19.9181	19.9218	19.9142	19.9326	19.9255	19.9326	19.9326	19.9218	19.9255	19.9181	(88)
util rest of house													
	0.9676	0.9565	0.9211	0.8313	0.6619	0.4209	0.2441	0.2481	0.5520	0.8335	0.9413	0.9706	(89)
MIT 2	18.7496	18.9060	19.2083	19.5649	19.8055	19.9194	19.9244	19.9315	19.8952	19.6368	19.1979	18.7871	(90)
Living area fraction									fLA = Living area / (4) =			0.3013	(91)
MIT	19.0356	19.1892	19.4934	19.8567	20.1124	20.2348	20.2466	20.2515	20.2040	19.9280	19.4796	19.0683	(92)
Temperature adjustment												-0.1500	
adjusted MIT	18.8856	19.0392	19.3434	19.7067	19.9624	20.0848	20.0966	20.1015	20.0540	19.7780	19.3296	18.9183	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9599	0.9478	0.9109	0.8236	0.6651	0.4352	0.2626	0.2674	0.5639	0.8269	0.9320	0.9635	(94)
Useful gains	575.9014	608.3004	636.8788	633.5626	530.9814	351.8180	202.5116	193.0030	375.8723	499.8553	536.3538	549.2020	(95)
Ext temp.	5.3000	5.7000	7.4000	9.9000	13.0000	15.8000	17.7000	17.8000	15.3000	12.0000	8.4000	5.5000	(96)
Heat loss rate W													
	1186.6528	1145.7089	1021.7218	835.6452	598.0039	361.0237	203.4333	193.9137	400.5540	662.7769	927.7615	1147.8988	(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													
	454.3991	361.1385	286.3232	145.4995	49.8648	0.0000	0.0000	0.0000	0.0000	121.2137	281.8136	445.4304	(98)
Space heating												2145.6827	(98)
Space heating per m2											(98) / (4) =	30.1589	(99)

8c. Space cooling requirement

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

Not applicable

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

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	90.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	2370.9201	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	454.3991	361.1385	286.3232	145.4995	49.8648	0.0000	0.0000	0.0000	0.0000	121.2137	281.8136	445.4304	(98)
Space heating efficiency (main heating system 1)													
	90.5000	90.5000	90.5000	90.5000	90.5000	0.0000	0.0000	0.0000	0.0000	90.5000	90.5000	90.5000	(210)
Space heating fuel (main heating system)													
	502.0984	399.0480	316.3792	160.7729	55.0992	0.0000	0.0000	0.0000	0.0000	133.9378	311.3962	492.1883	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	160.0848	140.4397	145.9635	128.7363	124.6254	109.1659	102.7713	115.6417	116.3472	133.6121	143.9323	155.5265	(64)
Efficiency of water heater												87.3000	(216)
(217)m	89.6440	89.5806	89.3936	88.9691	88.1911	87.3000	87.3000	87.3000	87.3000	88.7935	89.3922	89.6496	(217)
Fuel for water heating, kWh/month													
	178.5785	156.7746	163.2819	144.6978	141.3128	125.0469	117.7220	132.4647	133.2728	150.4751	161.0121	173.4828	(219)
Water heating fuel used												1778.1219	(219)
Annual totals kWh/year													
Space heating fuel - main system												2370.9201	(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)												344.2105	(232)
Total delivered energy for all uses												4568.2525	(238)

10a. Fuel costs - using BEDF prices (508)

	Fuel kWh/year	Fuel price p/kWh	Fuel cost £/year	
Space heating - main system 1	2370.9201	3.7400	88.6724	(240)
Space heating - secondary	0.0000	0.0000	0.0000	(242)
Water heating (other fuel)	1778.1219	3.7400	66.5018	(247)
Pumps and fans for heating	75.0000	20.4300	15.3225	(249)
Energy for lighting	344.2105	20.4300	70.3222	(250)
Additional standing charges			95.0000	(251)
Total energy cost			335.8189	(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	2370.9201	0.2160	512.1187	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1778.1219	0.2160	384.0743	(264)
Space and water heating			896.1931	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	344.2105	0.5190	178.6453	(268)
Total kg/year			1113.7633	(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	2370.9201	1.2200	2892.5225	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	1778.1219	1.2200	2169.3087	(264)
Space and water heating			5061.8312	(265)
Pumps and fans	75.0000	3.0700	230.2500	(267)
Energy for lighting	344.2105	3.0700	1056.7263	(268)
Primary energy kWh/year			6348.8075	(272)
Primary energy kWh/m2/year			89.2363	(273)

SAP 2012 EPC IMPROVEMENTS

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

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

(For testing purposes):

A		Not considered
B		Not considered
C		Not considered
D		Not considered
E	Low energy lighting	Already installed
F		Not considered
G		Not considered
H		Not considered
I		Not considered
J		Not considered
K		Not considered
M		Not considered
N	Solar water heating	Not applicable
O		Not considered
P		Not considered
R		Not considered
S		Not considered
T		Not considered
U	Solar photovoltaic panels	Not applicable
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	CO_2 change
(none)			

	Typical annual savings	Energy efficiency	Environmental impact
Recommended measures			
(none)			
Total Savings	£0	0.00 kg/m²	

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

Fuel prices for cost data on this page from database revision number 508 TEST (28 Oct 2022)
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	£86	£86	£0
Mains gas	£250	£250	£0
Space heating	£199	£199	£0
Water heating	£67	£67	£0
Lighting	£70	£70	£0
Total cost of fuels	£336	£336	£0
Total cost of uses	£336	£336	£0
Delivered energy	64 kWh/m²	64 kWh/m²	0 kWh/m²
Carbon dioxide emissions	1.1 tonnes	1.1 tonnes	0.0 tonnes
CO_2 emissions per m²	16 kg/m²	16 kg/m²	0 kg/m²
Primary energy	89 kWh/m²	89 kWh/m²	0 kWh/m²

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

No improvements selected / applicable

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

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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
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No improvements selected / applicable
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BASIC COMPLIANCE REPORT
Calculation Type: New Build (As Designed)

Design SAP
elmhurst energy

Property Reference	181 - PRJ012848	**Issued on Date**	16/11/2022
Assessment Reference	181	**Prop Type Ref**	2BF03 SAT 1F 4.9
Property	Southbourne, PO10		

SAP Rating	83 B	**DER**	19.66	**TER**	19.90
Environmental	86 B	**% DER<TER**	1.23		
CO_2 Emissions (t/year)	1.11	**DFEE**	49.48	**TFEE**	55.55
General Requirements Compliance	Pass	**% DFEE<TFEE**	10.93		

Assessor Details	Mr. Gary Nicholls, Gary Nicholls, Tel: 02033971373, gary@briaryenergy.co.uk	**Assessor ID**	W947-0001
Client			

SUMARY FOR INPUT DATA FOR New Build (As Designed)

Criterion 1 – Achieving the TER and TFEE rate

1a TER and DER

Fuel for main heating	Mains gas		
Fuel factor	1.00 (mains gas)		
Target Carbon Dioxide Emission Rate (TER)	19.90	$kgCO_2/m^2$	
Dwelling Carbon Dioxide Emission Rate (DER)	19.66	$kgCO_2/m^2$	Pass
	-0.24 (-1.2%)	$kgCO_2/m^2$	

1b TFEE and DFEE

Target Fabric Energy Efficiency (TFEE)	55.55	$kWh/m^2/yr$	
Dwelling Fabric Energy Efficiency (DFEE)	49.48	$kWh/m^2/yr$	
	-6.1 (-11.0%)	$kWh/m^2/yr$	Pass

Criterion 2 – Limits on design flexibility

Limiting Fabric Standards

2 Fabric U-values

Element	Average	Highest	
External wall	0.27 (max. 0.30)	0.27 (max. 0.70)	Pass
Party wall	0.00 (max. 0.20)	-	Pass
Floor	0.18 (max. 0.25)	0.18 (max. 0.70)	Pass
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	Pass
Openings	1.28 (max. 2.00)	1.30 (max. 3.30)	Pass

2a Thermal bridging

Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)	
Maximum	10.0	Pass

Limiting System Efficiencies

4 Heating efficiency

Main heating system	Boiler system with radiators or underfloor - Mains gas Data from database Ideal LOGIC COMBI ESP1 24 Combi boiler Efficiency: 89.6% SEDBUK2009 Minimum: 88.0%		Pass
Secondary heating system	None		

5 Cylinder insulation

Hot water storage	No cylinder		

6 Controls

Space heating controls	Programmer, room thermostat and TRVs		Pass
Hot water controls	No cylinder		
Boiler interlock	Yes		Pass

7 Low energy lights

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

8 Mechanical ventilation

Not applicable

Criterion 3 – Limiting the effects of heat gains in summer

9 Summertime temperature

Overheating risk (Southern England)	Not significant		Pass

Based on:

Overshading	Average		
Windows facing North Windows facing East Windows facing South Windows facing West	3.54 m², No overhang 1.44 m², No overhang 0.66 m², No overhang 3.24 m², No overhang		
Air change rate	4.77 ach		
Blinds/curtains	Dark-coloured curtain or roller blind, closed 100% of daylight hours		

Criterion 4 – Building performance consistent with DER and DFEE rate

Party Walls

Type	U-value		
		W/m²K	Pass

Air permeability and pressure testing

3 Air permeability

Air permeability at 50 pascals	5.01 (design value)		
Maximum	10.0		Pass

10 Key features

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